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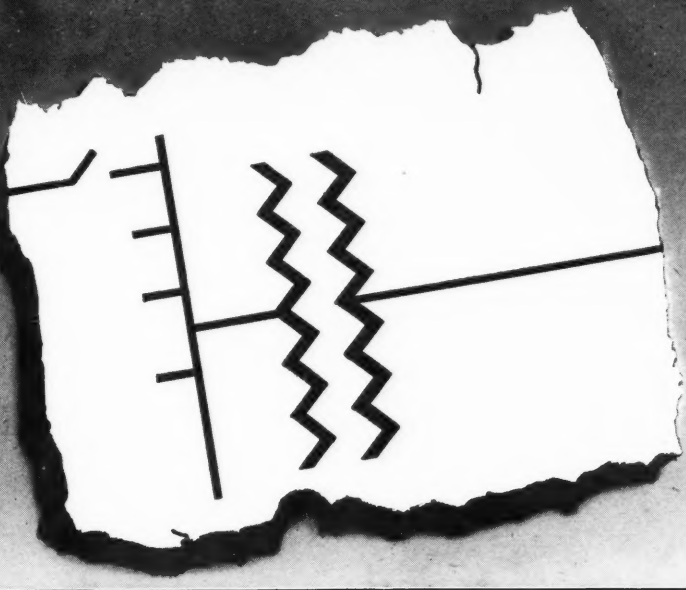

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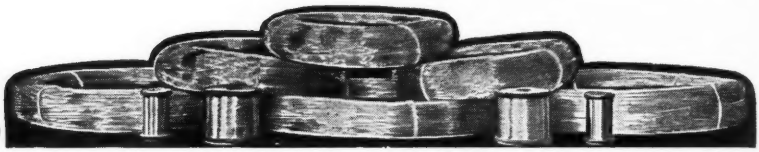

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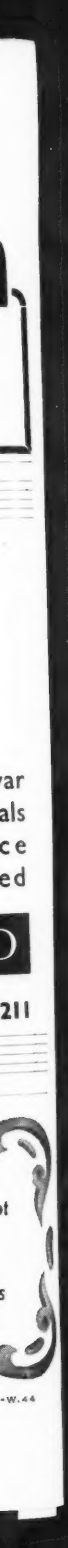

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ELECTRICAL REVIEW

November 12, 1943

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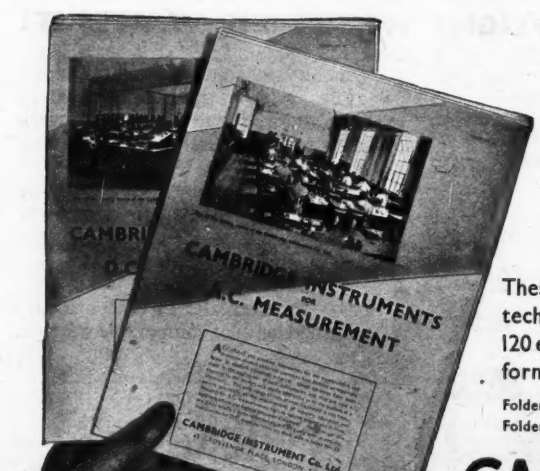

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXIII. No. 3442. NOVEMBER 12, 1943 6d. WEEKLY

Pit-head Generation

Influence of Cooling-Tower Developments

FUNDAMENTAL to the economic production of electricity is a right choice of site for generating plant and this implies the availability of water adequate in amount and temperature for condensing exhaust steam in order to minimise back pressure on the turbines. Until recent years this has meant that power stations intended for high thermal performance have had to be erected alongside the larger rivers.

Greater Freedom of Choice

A sufficient answer to queries often raised as to the possibility of locating stations in the coalfields used to be that for each ton of coal burned about 500 tons of water was required. The validity of this argument has been challenged by the modern development of the concrete hyperbolic cooling tower. Unlike its predecessor the wooden tower (batteries of which took up a large and valuable area), its use is by no means incompatible with the attainment of high thermal efficiencies which, it has been stated, may be within five per cent. of the figure attainable with equivalent riverside stations. Moreover, the flexibility it has permitted in the selection of sites (often on cheaper land) enables a station to be more readily located with regard to its function as an inherent part of a large integrated electrical system.

A notable feature of the generating plant programmes of the Central Electricity Board in the years immediately preceding the war was the number and capacity of new cooling towers for which they provided. No doubt this was due to the limits of efficient river cooling having been reached in many instances; and other advantages arising out of proximity to waterways, including the option it presents of using sea-borne coal with lower freight costs and, as a rule, of being close to load concentrations cannot be ignored. A commonly mooted alternative of seaside positions for generating plant has hitherto generally proved impracticable in view of the heavy civil engineering costs and operational troubles involved.

Cooling towers may be expected to entail an appreciably higher capital expenditure than would be incurred in pumping water from a river but, as Mr. H. S. Prosser shows in this issue, the balance may easily be wiped out by the saving of a few miles of transmission line or of coal haulage by rail.

Provision of Make-up Water

On the other hand, although the quantity of water necessary for artificial cooling as make-up is but a small fraction of that used with river cooling, it is, nevertheless, quite considerable. It is not clear that the requisite amount, free from acid, is present at the pits from which coal of the most suitable type for steam raising is obtainable, though, where the nearby population is large enough, chlorinated sewage effluent might well furnish the cooling medium.

It is evident, however, that bulk water supplies and relative location of load

(owing to grid interconnection and high voltages) have not the significance they had formerly. The issue in regard to pit-head generation has now become more nearly a straight comparison between the transmission of electricity and the transport of coal. While each case would need treatment on its own merits, there are many relevant matters that call for early investigation with a view to ascertaining the extent to which generation at the collieries is practicable.

The "Competition" Bogey

IN a comment upon the gas industry's re-organisation plan the *Daily Telegraph* repeats the inaccurate statement that "hostilities" between the gas and electricity supply industries "have been damaging alike to the interests of the producers and of the final user." We do not propose to go over the arguments again, but we feel that any repetition of this kind in a national newspaper calls for a protest. In any event the general prosperity of both industries, and the progressive decrease in price and improvement in service to the consumers have proved the falsity of the contention.

Hydro-Electric Limits

IN a report on reconstruction the Incorporated Association of Architects and Surveyors expresses the view that "the provision of a nation-wide supply of cheap electrical power would be the greatest single service that could be rendered to the community." Too much seems to be expected of hydro-electricity, however, the possibilities of which are assumed to have been hardly explored. Actually, numerous investigations have shown that potential economic developments are seriously restricted. The present proportion of the total kWh output of Great Britain that is generated by water-power is under 3 per cent. Even after allowing for possible further developments in the North of Scotland and on the Severn, this proportion seems unlikely to be extended so materially as to affect the general cost of supply.

Colliery Mechanisation

PROGRESS in machine mining is reflected in increase in plant capacity for coal cutting and conveying during recent years. In a review of electrical developments in the coalfields (*I.E.E. Journal*) Mr. J. A. B. Horsley shows that the 1942 figure of 281,000 HP under this heading is 22 per cent. better than it was in 1937, and compares with a general average advance of 13 per cent. which brought the aggregate HP in mines to 2,449,000. The installed capacity of the relatively few electric winders, in what (with the fans) is "the remaining stronghold of the steam engine," is 194,000 HP, an improvement over 1937 of 28,000 HP. Modernisation of winding methods in the future should therefore make a substantial difference to the total capacity of colliery installations.

Appearance

FUNCTIONAL aptness may not be a sufficient criterion of a well-finished job of work, as Mr. W. T. S. Atkins implied in his recent inaugural address as chairman of the I.E.E. North Midland Centre. To go beyond it, however, calls for uncommon tact and restraint in avoiding what may be a good deal worse than a severely utilitarian appearance. More often than not the need for harmony with surroundings is paramount. Especially is this so in domestic electrification, where unobtrusiveness may be the greatest æsthetic virtue. However pleasing to the eye and fit for its purpose a piece of apparatus may be, it will not necessarily be in accord with the owner's general scheme of decoration.

A Pipe Dream

ONE possible outcome of district heating should not be overlooked. However well the piping is lagged there will be some dissipation of heat *en route* and if the pipes are not too far below the surface there may be sufficient stray warmth to encourage vegetable growth. Should the public get to realise this, instead of the usual objections to wayleaves there will be a clamour for the privilege of having the mains running through the garden. If they are laid in the streets we may expect to see palm avenues in some of our towns.

More Copies

MEMBERS of the Forces and others who have been deprived of the *Electrical Review* through shortage of copies are now invited to place orders with their newsagents and to communicate with our Publishers if they have any difficulty in obtaining the journal. A limited number of additional orders can now be met.

Works Supply Scheme

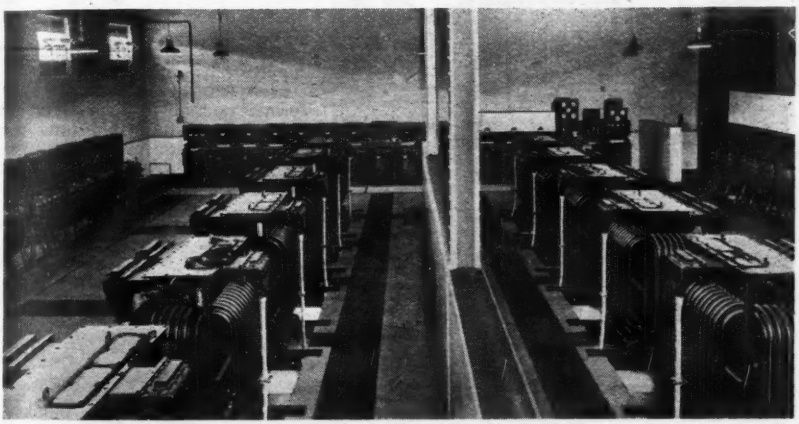
Modern Substation Lay-out

THE subject of this and a subsequent article is the general distribution scheme, from the incoming supply to the points of usage, in a very large factory which consumes well over 30 million kWh per annum, and has a maximum demand approaching 8,000 kVA. These figures alone emphasise the need for the meticulous planning which has brought the installation generally into line with the most modern developments, but throughout the whole scheme such planning has been influenced by the perhaps greater need for security which, in some cases, has resulted in departures from what might be considered orthodox factory distribution practice.

The factory covers a very large area with separate buildings connected by a road network. It receives two incoming supplies at 6·3 kV from a public supply system by means of underground cables which follow separate and widely spaced routes and terminate one in each of two of the three substations from which the whole of the factory system is supplied. The third substation is connected on the e.h.v. side with both Nos. 1 and 2 substations, but this interesting supply interchange scheme will be better described later when dealing with the switchgear layouts. In each case the main incoming cable communicates directly with the supply authority's main switch on the respective 6·3-kV substation switchboard. The supply is then taken through a metering panel and on to a consumer's main switch before there is direct connection to the switchboard busbars. Each of these main switches has 800-A and 25-MVA carrying and rupturing capacities, and the consumer's unit is equipped with a voltmeter, indicating and recording ammeters, a p.f. meter, and a polyphase kWh meter.

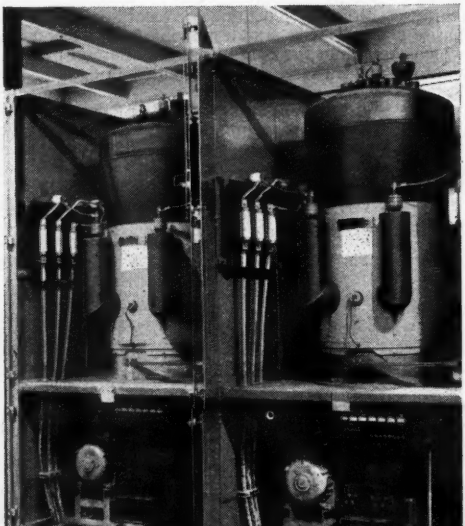
From the consumer's main circuit-breaker in each of Nos. 1 and 2 substations there are in a continuous line twelve transformer circuit-breakers all connected to common busbars, with a section coupler interposed at the mid-point of the board. This switchgear is Switchgear & Cowans Type E, internal vertical-isolation and horizontal draw-out truck equipment. Each transformer unit has carrying and rupturing capacities of 600 A and 25 MVA and is equipped with two overload and one earth-leakage trips and an ammeter provided with a phase selector switch. Finally, at the "far" end of each 6·3-kV switchboard there is an 800-A, 25-MVA circuit-breaker which controls an interconnector to No. 3 substation, so that there is in each case a 17-panel switchboard comprising 12 transformer, one supply authority main, one consumer's main, one busbar coupler and one interconnector units and a metering panel, and the two substation layouts are identical up to this point.

In No. 3 substation there is an e.h.v. switchboard of similar equipment with seven units—two 800-A circuit-breakers at the other ends of the interconnectors from Nos.



Full advantage has been taken of the spaciousness to afford an excellent layout

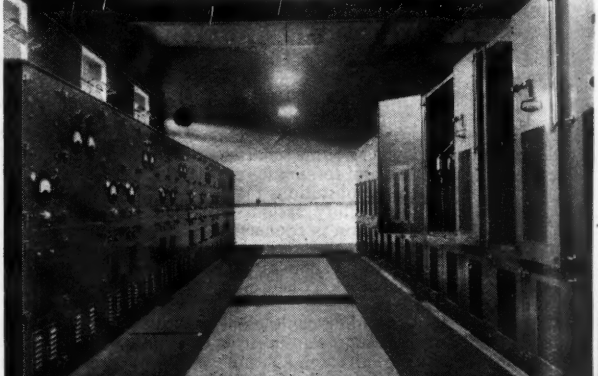
1 and 2 substations, a metering panel and four transformer 600-A circuit-breakers. All the breakers are rated at 25-MVA rupturing capacity. It will be seen then that not only can No. 3 substation be fed from either or both of Nos. 1 and 2 substations, but that the layout provides, if required, a supply interchange from, say, No. 1 substation to No. 2 substation, or *vice versa*, *i.e.* between the two main incoming supplies—a valuable scheme from the security point of view.



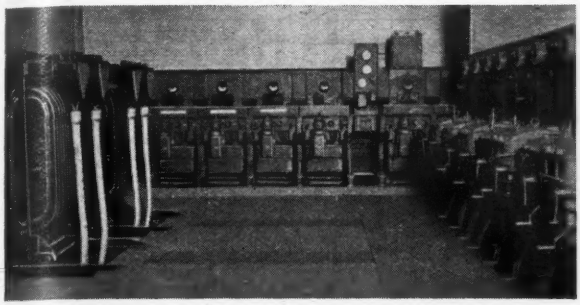
Each paralleled pair of pumpless steel-tank rectifiers has an output of 1,000 kW at 500 V, and the supply from each rectifier goes to an air-break circuit-breaker on the 500-V, DC switchboard

The six transformer units on one section of the switchboard in No. 1 substation control 12-phase transformers, each of which provides the input to two six-phase rectifiers for DC servicing. The rectifiers are of the G.E.C. pumpless steel-tank type and each pair, connected in parallel, has an output of 1,000 kW at 500 V, DC. The 1,460-kVA G.E.C. transformers supplying the rectifiers are naturally oil-cooled by means of air-cooled radiation tubes. Circuit-breakers Nos. 7 and 8, *i.e.* the first two of the second section, control 500-kVA B.T.H. oil-immersed transformers which provide a 400-V three-phase supply for the auxiliaries and lighting in the testing department, while the remaining four circuit-breakers control similar transformers which afford supplies at 400 V, AC for the assembly shop and ancillary buildings. All the transformer circuit-breakers in No. 2 substation serve similar 500-kVA transformers which provide 400-V, AC power and lighting supplies to the main area of the machine shops and works. All the transformers for the AC supplies are delta-star connected. All four of the transformer circuit-breakers in No. 3 substation control 500-kVA B.T.H. oil-immersed transformers for 400-V, AC works supplies.

The groups of two and four AC supply transformers in No. 1 substation, the two sections of six transformers each in No. 2 substation and the group of four transformers in No. 3 substation each serve separately a 400-V switchboard with a particularly interesting layout. Each transformer is connected directly to an 800-A oil circuit-breaker on either side of which is a 500-A (600-A in the case of No. 3 substation) oil circuit-breaker controlling an outgoing feeder. Thus, associated with



each transformer there is a symmetrical arrangement of one incoming and two outgoing circuit-breakers. Interposed between each of these symmetrical groups, however, is an 800-A circuit-breaker coupler, so that



The e.h.v. switchgear (back) is of the vertical-isolation and horizontal draw-out truck type; the 400-V switchboards (right) are composed of industrial oil circuit-breakers with free-handle and draw-out features

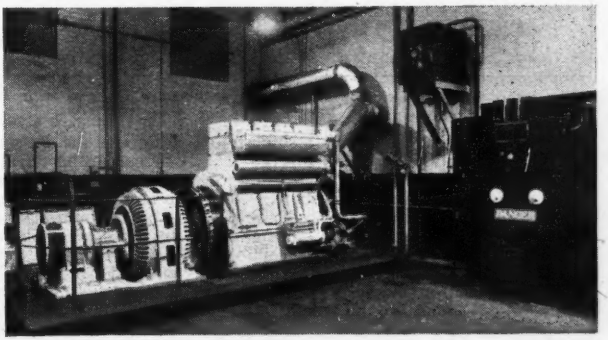
actually any number of transformers up to six in the case of each of the sections in No. 2 substation and two and four in No. 1 substation sections, and any number of transformers up to four in the case of No. 3 substation can be connected in parallel in an emergency and at the discretion of the works engineer. The normal practice is to run with the groups coupled in pairs and in this way the current that could be fed into any fault is maintained within easily controllable limits. In the case of the two units in No. 1 substation the group of coupler and transformer units is flanked by six outgoing units on either side.

The 400-V switchboards are composed of Ellison industrial-type oil circuit-breakers with free-handle and draw-out features and with three adjustable overload releases and time lags on each.

Auxiliary contacts which "make" when each circuit-breaker is opened provide lighting for the indicator lamps, etc. Each circuit-breaker has an ammeter and the feeder units each have a selector switch for measuring the phase currents separately on a single instrument. The l.v. busbars include the neutral.

To ensure that the lighting over any area of the factory shall not be interrupted completely by a fault, a portion of the lighting is taken from each of six transformers in No. 2 substation and from each of three transformers in No. 1 substation. By this means, should a fault occur in a feeder from any one of the transformers, only that part of the lighting associated with that particular transformer would be interrupted. As we shall show in the subsequent article the lighting distribution scheme is three-phase right up to the lighting distribution boards in the workshops.

The main 400-V circuit-breakers controlling the lighting are also of the Ellison industrial type and they are all of 300-A capacity. By virtue of identical physical dimensions and electrical capacity they are all interchangeable, and they are fitted with no-volt coils. They are all wired to a master controller in the substation office, so that, if at any time it is necessary quickly to black-out the factory, this can be done without the substation attendant having to move from his telephone. All the substations are inter-

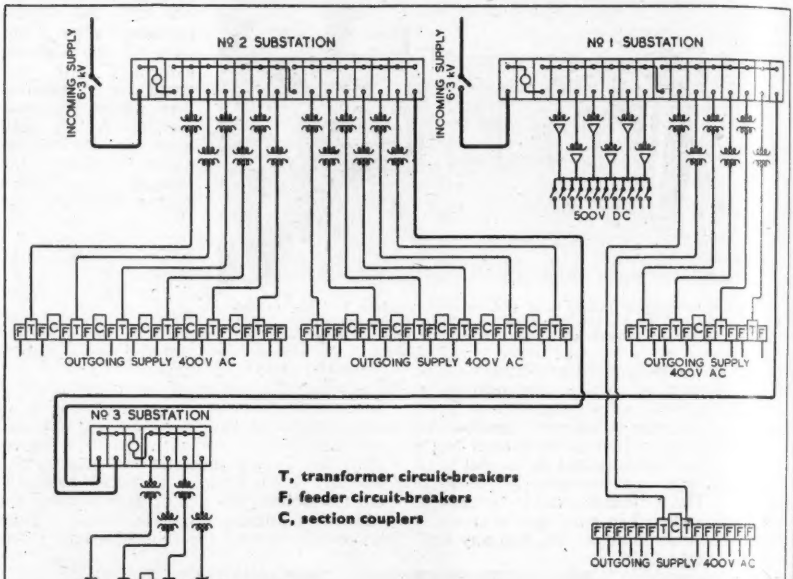


A scheme for an emergency supply is an important feature; 150-kVA Diesel-alternator set

connected on a remote-control system so that all or any of the substation lighting breakers can be tripped by the attendant in No. 1 substation.

Regarding the DC distribution system the supply from each rectifier is taken to a 500-V air-break circuit-breaker connecting the rectifier to the common busbar system of the

switchboard. On either side of each incoming circuit-breaker is a high-speed circuit-breaker controlling an outgoing feeder to one of the 550-HP variable-speed fans in the test department. Except that there are no couplers in this case, and the main purpose is not the is of special interest. One of the 400-V circuit-breakers in No. 2 substation serves such essentials as telephones, fire-alarm systems, syrens, danger warnings, fire-hydrant pumps, boiler feed pumps and automatic gas furnace controls. Should there be a complete



The layout provides for a supply interchange between the two main sources of supply and for feeding No. 3 substation from either

same, the arrangement is rather similar to that of the 400-V switchgear on the AC switchboards and it affords a measure of load equalisation along the busbars. The DC switchgear is all of G.E.C. production.

A special point about the substations described above is their rather exceptional spaciousness, full advantage of which has been taken to afford really excellent equipment layouts. Generally the scheme in each case provides an avenue of transformers at the centre with the e.h.v. and l.v. switchgear round the walls, the transformers and switchgear being mounted over pebble-filled oil drainage pits and cabling trenches. All this contributes to security, ease of operation and, above all, confidence, which are emphasised by the particularly neat cabling, the general cleanliness and the good lighting.

A scheme for an emergency supply to essential services throughout the factory is an important feature of the installation and failure of the incoming supply the loss of voltage on this circuit-breaker would allow a magnetic valve which supplies lubricating oil to an emergency Diesel-engine alternator set to operate automatic control gear for starting up and establishing an emergency supply to this particular essential-services feeder. A solenoid energised from the essential-services feeder maintains in the closed position a valve in the pipe connection from a gravity oil tank to the Diesel-engine bearings. Once this pipe is filled the oil builds up in a branch line a pressure sufficient to start up a servo-motor valve which allows air to pass from a storage cylinder at 300 lb. per sq. in. and thus start up the engine. After the engine has fired, its own lubricating-oil pump builds up a higher oil pressure which closes the servo-motor valve and shuts off the gravity oil tank and starting air. The engine now runs up to speed which is governed for 50 cycles at all loads. When full voltage is

attained by the alternator its own circuit-breaker automatically switches on to the common busbars. When the normal supply is restored the alternator circuit-breaker is tripped by hand ; then the normal supply circuit-breaker automatically closes by solenoid operation and its rapid operation ensures continuity of supply. The Diesel set is a four-cylinder English Electric plant of 220 HP, 150-kVA output at 0·8 p.f.

Electrical Power Engineers

Discussion of the Salary Question

A COMMUNICATION was recently received by the E.P.E.A. from the Minister of Labour suggesting that by increasing shift workers' hours, or by modifying the present system, it might be possible to release members of the staffs of some undertakings for the Forces or for employment elsewhere in the industry.

The matter was referred to the National Service Committee which came to the conclusion that as such an alteration would impose too great a strain on the remaining staffs, and possibly endanger the continuity of supply, it was not advisable, even if it were practicable, which was doubted.

Negotiations with Employers

At a meeting of the National Executive Council of the Electrical Power Engineers' Association last month a report from the Salaries Adjustment Sub-Committee was considered. The Sub-Committee considered that while Clause 39 of the N.J.B. Schedule (relating to cost-of-living variations) had operated satisfactorily in peacetime, during the war conditions had been radically altered and the provisions of the clause were no longer adequate.

Two alternative schemes were submitted. The first proposed an increase of 15 per cent. in all salaries. The second suggested the amendment of the clause by increasing the amount to be added to or deducted from salaries for a five-point rise or fall in the cost-of-living.

While the second scheme was generally favoured by the Council members it was pointed out that negotiations were already in progress with the employers for an increase in salaries. The report was adopted and it was then moved that should the present negotiations fail the second scheme should be presented and pressed to arbitration. An amendment to this motion was finally passed instructing the Negotiating Committee to proceed with the present claim and press that to arbitration if necessary.

Revision of the Schedule

The revision of the N.J.B. Schedule has been advocated for many years and the matter was further discussed at the meeting when it was proposed that a special committee should be appointed to deal with the matter. One member considered that any attempt to revise the schedule as a whole was to be deprecated as it had proved a " scientific instrument of inestimable value." Another suggested that the question should be referred to the Post-War Planning Committee as conditions in the industry after the war would be very different from those prevailing at present.

It was finally decided to set up the proposed committee and five members were appointed.

Later a notice of motion from the Southern Division was considered asking that a new post-war schedule should be negotiated which ought to contain more designated posts than the present one and should give details of duties for such posts. At present only seven of the nineteen grades are designated. The proposal was referred to the Schedule Revision Sub-Committee.

Further proposals relating to the clauses dealing with the conditions of day workers, especially with regard to stand-by duties, were also referred to the Sub-Committee.

Meter Superintendents

A report by the Meter Superintendents Sub-Committee was adopted and referred to the National Investigation Committee following some discussion concerned chiefly with the line of demarcation between categories of meters personnel to be catered for by the manual workers' trade unions and the E.P.E.A. There is a Meters Joint Sub-Committee consisting of representatives of the trade union sides of the N.J.I.C. and the N.J.B. for the Electricity Supply Industry.

The Planning Report

Replying to criticisms by members of the Association's Report on Post-War Planning for the Electricity Supply Industry, the *Electrical Power Engineer* contends that although the members were not asked for their approval of the report before its publication it still fairly represented the views of the Association as a whole. The views of the Sections had been obtained and members had been asked to make suggestions. Members of the Post-War Planning Committee had addressed general meetings and had been assisted by opinions then expressed.

Power Stations in the Coalfields

Their Feasibility in the Light of Modern Developments

By H. S. Prosser,
B.Sc., A.M.I.Mech.E., A.M.I.E.E.

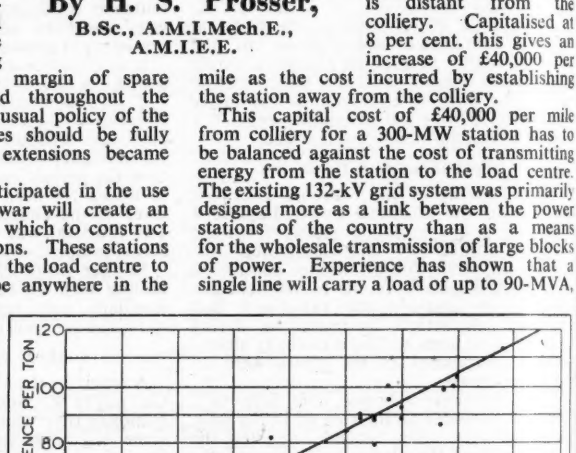
BEFORE the passing of the Electricity (Supply) Act, 1926, the siting and building of a power station was the sole responsibility of the undertaking concerned and it was the practice to build it as close to the centre of gravity of load as possible.

The 1926 Act vested in the Central Electricity Board the responsibility for directing undertakings to extend and establish stations, thus elevating electricity generation from a local to a national concern. The construction of the 132-kV grid lines enabled better use to be made of existing efficient plant and the margin of spare capacity to be reduced throughout the country, but it was the usual policy of the Board that existing sites should be fully developed when plant extensions became necessary.

The great increase anticipated in the use of electricity after the war will create an urgent need for sites on which to construct entirely new power stations. These stations need not be adjacent to the load centre to be supplied, but may be anywhere in the British Isles. The most important issue will undoubtedly be whether it is cheaper to transmit electricity or to transport coal, that is, whether the station shall be in the coalfields or near the load centre, the question of adequate water supply being the next consideration.

The cost of transport is an appreciable part of the total cost of coal delivered to a power station. Various factors are involved in the computation of railway rates, but the transport charge is approximately proportional to the distance from colliery to station. In the graph, transport charges per ton are plotted against distance for an undertaking which takes coal from a large number of collieries. An average line drawn through the points shows that there is a fixed and a mileage component of cost, the latter being nearly one penny per mile. This mileage charge is of vital economic importance in determining a power station site. Thus, considering a station of 300-MW capacity with a thermal efficiency of 26 per cent. on kWh sent out, burning coal of a gross calorific value of 10,000 BThU's per lb. and operating at a load factor of 50 per cent. (a fair average figure for a station throughout its twenty-year life), the mileage charge represents an annual cost of nearly £3,200 for every mile the station is distant from the colliery. Capitalised at 8 per cent. this gives an increase of £40,000 per mile as the cost incurred by establishing the station away from the colliery.

This capital cost of £40,000 per mile from colliery for a 300-MW station has to be balanced against the cost of transmitting energy from the station to the load centre. The existing 132-kV grid system was primarily designed more as a link between the power stations of the country than as a means for the wholesale transmission of large blocks of power. Experience has shown that a single line will carry a load of up to 90-MVA,



Representation of transport charges in relation to distance from colliery

but in view of the progress which has been made in high-voltage technique and in the light of experience abroad, a higher voltage system could probably be used with advantage where bulk transmission of the

greater part of a power station's output is required, assuming a proportion to be consumed locally.

The cost of such a super-grid is at the present time highly problematical, but its capital cost, even after capitalising transmission losses and maintenance, is likely to be less than £40,000 per mile. There would thus appear to be a *prima facie* economic case for the transmission of electricity as against the transport of coal. Continuity of supply is the score upon which such a scheme is most open to criticism, but similar transmission systems, such as the Boulder Dam scheme, have apparently vindicated themselves in countries far more prone to lightning and other natural hazards than is this country. Further, experience of the 132-kV grid is not such as to raise grave doubts on this issue.

Rivers or Cooling Towers

If stations are to be built in or near coalfields, the usual requirements of a power-station site will have to be met, the most vital of these being cooling water for the condensers. It has been the practice where possible to build a station adjacent to a river of such a size that an abundant supply of cooling water is available. There is, however, a limit to the number of stations that can be built on the banks of the very few large rivers of this country. Each additional station has the effect of raising the average river water temperature until eventually the back pressure, and consequently the efficiency, obtainable with river - water stations will show no improvement on that realised by modern cooling-tower stations. This condition is rapidly being approached, for example, on the River Thames, where the average river temperature has already risen several degrees. On the other hand, due to modern development in cooling towers, the vacuum obtainable by this means is steadily improving and a cooling-tower station is now in operation with a back pressure of only 0·6 lb. per sq. in.

For a typical riverside station the capital cost of the civil engineering works associated with tapping the river would amount to approximately 10s. per kW installed. The cooling towers for a modern station would, at corresponding price levels, cost £1 per kW. Thus, even should a suitable riverside site be available close to the load centre, the margin of 10s. per kW, amounting to £150,000 for a 300-MW station, must be set against the £40,000 per mile saving effected by building a station in the coalfields. Ignoring transmission costs, by moving the station only four miles nearer the coalfields the financial benefit of a riverside site is wiped out.

The question of cooling water is therefore unlikely to weigh greatly against the argument for establishing stations in the coalfields, always provided that the quantity of water required by a cooling-tower station is available.

Calculations show and experience has proved that a modern cooling-tower station operating at 600-lb. per sq. in. pressure with four stages of bled-steam heating evaporates 6·25 lb. of water for every kWh generated. In order to keep down the concentration of solids and/or acids in the cooling water the cooling ponds have to be purged by running an equal amount to waste. A total make-up of 12·5 lb. per kWh generated is therefore required. Allowing for the probable operation of the 300-MW station at 80 per cent. load factor for the first few years of its life, 5,760,000 kWh will be generated per day, requiring some 72,000,000 lb. of cooling water make-up.

This water may be obtained either by utilising sewage effluent water or from a small river, or from a combination of the two. The use of sewage effluent implies proximity to a fair-sized town; the quantity mentioned would be available from a town of about 250,000 population. If the source is a river flowing at 3 m.p.h. its cross-section would have to be 3 sq. ft. in order to give this quantity but, as the river conservators would probably not allow more than one-tenth of the total flow to be withdrawn, the cross-section would need to be of the order of 30 sq. ft.

It is important to ensure that a power station site in or adjacent to coalfields has not been and is not likely to be undermined by mining operations,* but this should not present insuperable obstacles.

Choice of Sites

Since the coalfields of the country are to be found in the counties of Northumberland, Durham, Lancashire, Derbyshire, Nottinghamshire, Leicestershire, Staffordshire, Shropshire, Worcestershire and Warwickshire, in addition to South Wales and parts of Scotland, it will be realised that to take the power stations to the coalfields would not unduly restrict the choice of sites, nor would transmission distances need to be unduly long as judged by modern standards.

A 300-MW station has been quoted above purely as an example, for the size of station would be related to the quantity of coal available in a particular district, the cooling water supply and the physical dimensions of the site. To accommodate the wide variations in the characteristics of coal as between the various coalfields, the most suitable type of chain-grate or retort-stoker or pulverised fuel-fired boilers could be installed, and it is safe to say that no coal

* See *I.E.E. Journal*, Part II, June, 1942. F. Favell "Some Considerations Concerning the Siting of Power Stations."

mined in this country could not be burnt by one of these three methods.

So much for technical considerations. In the political field, matters are considerably more indeterminate. For example, it has been suggested that, after the war, coal prices may be brought to a common level throughout the country, thus making price independent of proximity to a colliery. Such financial juggling would not, however, alter the fact that judged by the true yardstick of economy —the most efficient utilisation of the national effort—it is more economical to consume coal as near the source of its production as possible.

If such stabilisation were effected it is incontrovertible that someone must pay the cost of transport, even if only indirectly, and in the light of past experience the electricity supply industry would undoubtedly be saddled with at least a proportion of such cost.

This consideration inevitably raises the very important issues of coal marketing and price control and it is to be hoped that in the post-war years public utilities as, in the aggregate, the largest potential consumers of coal, will have a far larger say in these matters than hitherto.

It is evident from the foregoing that no hard and fast rules can be formulated in relation to the siting of power stations and it is imperative that, because of the several requirements to be met, every site shall be subjected to detailed and exhaustive investigation. It is suggested, however, that in view of the changing balance of the various economic factors involved, the general policy of locating stations in or adjacent to the coalfields should be given serious consideration.

Forthcoming Events

Institution of Electrical Engineers.—Monday, November 22nd, 5.30 p.m. Informal discussion on "The Administrative Structure of Electricity Undertakings," to be opened by Mr. G. V. Harrap.

Thursday, November 25th, 3 p.m. Lecture on the life and work of Nikola Tesla, by Dr. A. P. M. Fleming, C.B.E.

Wireless Section.—Tuesday, November 16th, 5.30 p.m. Discussion on "The Role of Ultra-High Frequencies in Post-War Broadcasting," to be opened by Messrs. K. I. Jones and D. A. Bell.

Measurements Section.—Friday, November 19th, 5.30 p.m. "Instrument Transformers," by Mr. A. Hobson.

North Midland Students' Section.—Saturday, November 13th, 2.30 p.m. Griffin Hotel, Leeds. "The Protection of Power Transformers," by Mr. H. W. Oldham, M.A.

North-Western Students' Section.—Friday, November 19th, 6.30 p.m. Engineers' Club, Albert Square, Manchester. "The Remote Control of High-Voltage Switchgear," by Mr. J. A. Barnett.

West Wales (Swansea) Sub-Centre.—Saturday, November 20th, 3 p.m. Guildhall, Swansea. Address by Mr. H. Coope.

North-Eastern Centre.—Monday, November 22nd, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-on-Tyne. "The Future of the Domestic Wiring Installation." Section 1: "Immediate Developments," by Messrs. W. J. H. Wood and Forbes Jackson. Section 2: "The Distant View," by Messrs. G. Smith and E. Jacobi.

North Midland Centre.—Tuesday, November 23rd, 5 p.m. Great Northern Hotel, Wellington Street, Leeds. Papers on domestic wiring (see N.E. Centre).

Derby Society of Engineers.—Monday, November 15th, 6.30 p.m. School of Arts Lecture Theatre, Green Lane. "Post-War Planning, with Special Reference to Coal," by Mr. E. G. Phillips.

Association of Supervising Electrical Engineers.—Saturday, November 13th, 2 p.m. Magnet House, Kingsway, London, W.C.2. Joint meeting with Institution of Engineers-in-Charge. Lecture, illustrated by demonstrations, on "Sound Reproducing Equipment," by Mr. H. D. Murdoch.

Manchester Association of Engineers.—Saturday, November 13th, 2.30 p.m. Engineers' Club, Albert Square. "Control of Hydraulic Power," by Mr. E. Bruce Ball.

Association of Mining Electrical and Mechanical Engineers.—*West of Scotland and Ayrshire Branches.*—Saturday, November 13th. "Pumps and Pumping Problems" (illustrated), by Mr. W. Boyle.

South Wales Branch.—Saturday, November 20th. Pontypridd. "First Principles: their Application in the Design of Electrical Equipment," by Mr. J. B. J. Higham, M.I.E.E.

Royal Society of Arts.—Wednesday, November 17th, 1.45 p.m. John Adam Street, Adelphi, London, W.C.2. "The Coming-of-Age of the B.B.C.," by Mr. Stuart Hibberd.

Electrical Trades' Commercial Travellers' Association.—Friday, November 19th, noon. Clare House, 55, Kingsway, London, W.C.2.—Annual general meeting.

Institution of Mechanical Engineers.—Friday, November 19th, 5.30 p.m. Thomas Hawksley Lecture: "Gyroscopic Principles and Applications," by Prof. C. E. Inglis, O.B.E. This lecture will also be given at Cardiff on Tuesday, November 23rd (3 p.m.).

Institution of Civil Engineers.—Tuesday, November 23rd, 5 p.m. "Post-war Transport in Great Britain," by Mr. B. D. Richards, B.Sc.(Eng.)

Institution of Factory Managers.—*South Eastern (London) Branch.*—Saturday, November 20th, 2.45 p.m. Bonnington Hotel, Southampton Row, W.C.1. Inaugural meeting.

Bonded Deposits

Causes and Possible Remedies

AT a joint meeting of the Institutions of Electrical and Mechanical Engineers on November 4th, the two papers to which reference was made last week, on the subject of bonded deposits on the heating surfaces of steam boilers, were discussed. Sir A. Stanley Angwin, President of the I.E.E., disposed of the formal business and then vacated the chair in favour of Professor F. C. Lea, Pres.I.Mech.E., who presided during the discussion.

The opening speaker was Mr. M. H. Adams (Lancashire Electric Power Co., chairman of the Boiler Availability Committee) who said that the trouble with bonded deposits had increased very considerably in recent years. The problem was world-wide and other countries had made very considerable efforts to relieve the situation. The fact that all efforts had failed to provide a cure indicated that the problem was a very complex one.

Sulphuric Acid Formation

The chemistry in the two papers had been so simplified and idealised as to make it rather misleading. Mr. Harlow was almost certainly right that sulphuric acid vapour was created during the passage of the gases through the superheater, but there was the possibility that it was formed in very much larger quantities in other ways. Aluminium salts could act as a bonding material in the economiser but, again, other substances might play a similar part in other portions of the plant. The mechanism as described by Messrs. Rylands and Jenkinson was ingenious, but he found it very difficult to understand how SO_3 found its way through half an inch of very solid scale. Had the authors any proof of that?

There had been cases of immunity from bonded deposits due to efficient stoking or efficient soot blowing. He failed to see how the chemical cleaning suggested by Messrs. Rylands and Jenkinson could be carried out while the plant was in place. The trouble had increased with increased superheat temperature, but other things had also changed with that increase. They were trying to get more and more per sq. foot of heating surface and grate area. Therefore, the question of rating required much more careful investigation.

The efficiency of a base load station was of less importance than the efficiency of the area in which it operated and if less emphasis were laid upon efficiency and ratings and more on availability, a better all-round efficiency in the area would be obtained. The Boiler Availability Committee was doing its best to solve this problem and developments during the past few months had been very helpful indeed, but any outside help should be warmly welcomed.

Mr. L. S. Fosbrooke (London Power Co.), remarking that the papers dealt only with part of a very complex problem, said that one large power company had recently considered a large boiler plant without air heaters. His own view was that boiler plants should be designed around this problem of bonded scale. All new projects should be pulverised fuel fired when the geographical and other factors were favourable. This system of combustion had relative immunity from both high and low temperature deposits although it was a borderline case in the latter respect, as Mr. Harlow pointed out. Superheating beyond 800 deg. F. could be carried out by means of radiant heating and would be an advantage, but when he had put forward that suggestion some time ago it was immediately vetoed by an eminent engineer who doubted whether a tube material existed which would stand up to it. Even if the cost was quadrupled over the convection equivalent, it would still be economical if it kept the boiler on the line and averted expensive renewals and maintenance. A suggestion that merited serious consideration was that the primary superheater should be integral with the boiler.

Trouble-free Pulverised Fuel Plants

Mr. F. Shakeshaft (C.E.B.; vice-chairman, Boiler Availability Committee) said that pulverised plants had proved to be capable of running from one annual survey to another without any trouble, and a few stoker-fired plants had given equal availability, but the latter was by no means general.

There was definite evidence that the trouble had materially increased during the war period due to the use of slacks containing large quantities of fines in generating stations. Stoker modifications were being carried out and they indicated the necessity for restricting the quantity of fines in the coals used. It was suggested that the proportion of fines should be governed by their heating index and ash content.

Mr. B. M. Thornton (I.C.I. Alkali) said his company had been operating stoker-fired high-pressure boilers with moderately high superheats for some ten years. They were equipped with air heaters and they had been comparatively free from serious fouling and corrosion troubles. But as they were not altogether free his company developed its

own dew-point apparatus, similar in principle to that of Mr. Harlow's.

More general investigations would assist in solving some of these problems, otherwise either steam temperature could not be allowed to rise above about 780 deg. F. or the exit flue gas temperatures must be allowed to increase substantially. In either case, the firing of boilers by mechanical stokers might suffer from a disadvantage when compared with pulverised fuel. While he did not know of any water washed installations in this country, in America some years ago the method was found satisfactory for boilers fired with pulverised fuel, oil or gas.

Examination of Evidence

Mr. F. Fraser Ross (British Coal Utilisation Research Association) said that Mr. Harlow's theory was being examined by his Association. Although personally he was not prepared to subscribe to the theory at the present stage, he was unable to point to one solid fact against it. Until there was evidence that constituted proof, it would be wise not to jump to the inevitable and unpleasant conclusion that superheat temperatures above 850 deg. F. were impracticable unless a satisfactory means of coating the tube surfaces could be found, or boilers could be radically redesigned.

Mr. R. Llewellyn Rees (London Power Co.) said that while Messrs. Rylands and Jenkinson had given a most ingenious theory he thought they had failed to prove that no other was valid. The complexity of the problem suggested that several different mechanisms might operate simultaneously, so that there was still a wide field for investigation. The paper by Mr. Harlow set out a theory against which it seemed impossible to produce any valid scientific arguments.

If the dangerous concentration of SO_3 were present in the gases leaving the combustion chamber, relative freedom from this trouble could best be restored by suitable modification of the combustion process. Recent work held out promise that this could be done in at least some of the isolated cases that had been examined.

Mr. L. F. Jeffrey (West Midlands J.E.A.) said he had been fortunate with economiser performance and the major proportion of the trouble he had experienced had been with superheaters. Personally he favoured the suggestion by Mr. Adams that the loads on the grates should be reduced reasonably and that ratings should be carefully considered. Notwithstanding what had been said concerning pulverised fuel firing, serious consideration must still be given to stoker-fired plants because many engineers were precluded from using p.f. plants owing to the difficulty of installing electrostatic precipitators and the still greater difficulty of disposing of large quantities of fine ash. Increasing superheat temperatures must still be the goal because maximum efficiency was only to be obtained in that way.

Dr. A. A. Taylor (Mitchell Engineering Co.) did not think that Mr. Harlow's conclusions were quite justified because of the very great differences between the experimental conditions and the practical conditions. For instance, in his experiment Mr. Harlow was using a much cooler gas and probably one which contained a much larger proportion of air whereas the actual superheater would probably contain very little oxygen. The iron oxide on the tube which was found to be a most effective catalyst would not be operative under practical conditions because the tubes in normal boiler practice would be coated with deposit after a very short running period. It was said that p.f. plants never had a high dew-point, and it would be interesting to know if that was really a catalytic effect or not. Mr. Harlow's paper suggested at times that it might not be.

Mr. G. Nonhebel (I.C.I., Billingham) said it would be useful to have operating experience on air pre-heater corrosion in oil and gas-fired boilers generating medium and high temperature superheated steam, allowance being made for the increase in dew-point due to higher partial pressure of water vapour. If the corrosion increased with steam pressure as on stoker-fired boilers, then it would appear that the dust deposits from p.f. firing were protective.

Croydon Experiments

Mr. C. W. Lees (Croydon Electricity Department), remarking that the moisture due to the combustion of hydrogen could not be eliminated, asked whether the authors considered the drying of pulverised fuel before firing of much importance in the elimination of bonded deposits in p.f. boilers. As regarded stoker-fired boilers, experiments carried out at Croydon had greatly reduced the bonded deposits on the economisers and superheaters. Two boilers had been fitted with air booster ducts in the stokers and this had, to some extent, simulated the conditions on p.f. boilers.

Mr. D. Northall-Laurie spoke of experiments in which lime dust was added to the flue gases in a Stirling boiler plant. Measured quantities of dust were blown in immediately over the economiser. At first the quantity was 3 per cent. based on the quantity of coal actually burned, and it was found that no deposit was formed in the air heater and no corrosion took place. This quantity, however, was gradually reduced and eventually it was found that less than 2 per cent. of lime dust would prevent any deposit of sticky material. This appeared to be a solution of the problem in that case.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Transformer Restrictions

FURTHER to my letter in your issue of October 29th, detailed study of the Electrical Transformers Order, 1943, in carrying out transformer contracts has revealed what appear to be anomalies, which have been referred to the Board of Trade with, it is hoped, helpful suggestions. My inferences from the Order and the B.S.I. Amendment to B.S. 171/1936 are as follows:—

In the first place, from the publication of tables of iron and copper losses which cease at 40 kV, some have concluded that only transformers whose higher-voltage windings are between 700 V and 40 kV are included, but the wording of the Amendment, repeated in the Order, covers transformers having "a service voltage" within that range and does not exclude transformers which also have one or more service voltages above or below it. (I think it likely that "whose highest voltage" was intended.)

While a transformer of, say, 1,000 kVA, 66 kV/400 V, is not covered by the Order, a transformer of 7,500 kVA, 33 kV/132 kV, undoubtedly is, as it has *a* service voltage within the specified range. Where a transformer has more than one voltage within the range, we shall be safe in adopting the losses scheduled for the higher of those voltages, but whether the wording makes that compulsory I am not sure, there being a choice available.

The Amendment does not discriminate between methods of connection, and a 1,000-kVA three-phase 50-cycle transformer, 11 kV/66 kV, must have losses not less than 4,060 plus 11,400. This holds good if auto-connected, when the equivalent size will be that of a 400-kVA double-wound transformer, and it will take some doing, and even more so with auto-transformer boosters.

The B.S. Amendment employs an unsatisfactory sentence: "the use of lower quality electrical sheet steel." Lower than what? In the absence of definition it is reasonable to take as standard the ordinary normal steel of the principal make, namely, "Stalloy" of 0·63 W per lb. at B = 10,000, 50 cycles. The best course appears to be to use the standard material and "dilute" it with electrical sheet iron, having regard to the differing permeability and consequent care to avoid cross flux.

Regarding temperature-rise limits, I had read the B.S. Amendment as allowing, for oil-immersed naturally cooled transformers, a figure of 52 deg. C. in place of the old 50 deg. and that any lower temperature is allowable. However, I am not now sure of this, and it is not now material, since the wording in the Order differs. The official interpretation of the Order, Second Schedule, Clause 8, is that the temperature rise of transformers as above, must lie between 48 and 52 deg. C. This limit of precision will not be easy, especially with a basis of iron loss less accurately obtainable.

The Board cannot reasonably be held accountable, since it expects adequate guidance from the British Standard Specifications, whose Amendment requires thorough reconsideration and recasting. I write in no spirit of criticism; difficulties are to be expected in the early stages of an innovation, but it is useless to ignore them; they must be stated so that action can be taken to straighten them out. In the meantime I recommend that anything in doubt should be referred to the Board of Trade, whose officers will be found very helpful. The Board has authority to issue dispensations from the Order, by licence, upon the necessity for it being demonstrated.

Hackbridge. W. C. KENNETT, *Director*,
Bryce Electric Construction Co., Ltd.

Domestic Fused Plugs

THE interesting article by Mr. R. Amberton on a proposed standard design of plug and socket (*Electrical Review*, October 29th) raises a number of points, including the necessity for compromise in the matter of the rating of fuses relative to their loads.

It must be conceded that it is a practical impossibility to protect every small current-consuming device against overload by a suitably rated fuse having the appropriate fusing factor. Overload protection for small powers can be effected only by a precision unattainable in practice outside the laboratory, and so long as a fuse gives a certain and rapid break under anything approaching short-circuit conditions with discrimination between circuit fuses and the main fuses, it is the best that can be hoped for in domestic work.

Presumably in the interests of standardisation, Mr. Amberton advocates a plug of 10-A capacity which is apparently to embody a fuse rated at 10 A which will, no doubt, have a fusing factor within the limits laid down by B.S.S. 88. This standard rating of 10 A is a compromise necessitated by the difficulty of ensuring that an unskilled user will fit

a replacement fuse of the correct rating, even if a range of fuses is available. The proposal appears to me to be as simple and satisfactory a solution as is possible.

Mr. T. C. Gilbert in his letter in your issue of November 5th complicates matters by the introduction of three sizes of fused plug, of 2-, 5- and 10-A rating, because of the undesirability of feeding a standard lamp through a 10-A fuse. Small domestic current-consuming apparatus invariably blow fuses because of short-circuit conditions, and therefore there is little practical objection to protecting them by a good quick-acting 10-A fuse. It is not necessary, I should imagine, to use a 10-A flexible for, say, a reading lamp, as there should be no difficulty in accommodating a smaller flexible in a standard 10-A plug.

I feel, therefore, that the simplification that will result from the adoption of one standard 10-A fused plug for domestic use, with only one rating of fuse for the housewife to handle, will far outweigh any academic consideration of more effective protection.

Audenshaw, Manchester. F. E. RYDER.

Domestic Fused Plugs

WITH reference to Mr. Amberton's article in your issue of October 29th, I suggest that a solution of the fused plug problem would be a separate component containing two fuses only, inserted between the fixed wall socket and the plug of the apparatus to be connected.

This would obviate the difficulty of designing a fused socket and plug combined and also cheapen the cost to the consumer in that only one or two of these fused units would be required per house, because they could be transferred from point to point. These units could be made quite small and mass-produced very cheaply. Provision must be made so that an appliance could only be plugged into the fuse unit and not the main socket, but that would cause no difficulty in design; all that would be required would be to have different centres between the plug pns in the two components.

Welling, Kent. E. CHRISP.

New Administrative Association

MY attention has been drawn to a letter written by Mr. Woodville appearing on page 579 of your issue of October 29th, and I shall be very grateful if you will permit me to make a reply.

Mr. Woodville will find the answers to his questions set out clearly in the announcement which appeared in your issue dated October 15th.

Due to the widespread interest created by the announcement, all those with a legitimate interest in the formation of the Association will shortly receive an intimation from the honorary secretary, inviting them to become members. Contrary, therefore, to Mr. Woodville's suggestion, the Association will not consist of a small group of people forming themselves into a body of specialists within the administrative structure of the industry, but a large group of such people.

Many people share Mr. Woodville's view that there are organisations whose sole objects appear to be the pursuit of their own sectional interests, and it is partly due to that precise reason that the new Association has been formed.

London, E.5. J. E. ROBERTSON, *Chairman*, Electricity Supply Administrative Association.

[A letter upon similar lines to the above from Mr. V. Haworth, of Rugby, indicates that interest in the new Association is not confined to London.—Editors, *Electrical Review*.]

I WAS having a look through the Boss's *Elec Rev* before he came in and spotted mister Woodvilles letter where he dident fancy the idea of the Elec Supply Adminerstrative assoc & had the windup over the Elec Supply office boys. Me and the other messenger boy here dont intend to have anything to do with the office boys assoc no fear & think it is time we had an affair of our own why not. We are pretty Important in our line and may work up to be Kings Messengers. I have seen the Boss and lots of the other littler bosses etsetrer all Upset and anshously waiting when Ive been a bit delayed & the Power Station Suprintendent says he couldent manage without me so that shows you. So what about a Elec Supply Messengers Union. P.S. We might let office boys in and young engineers at a Special Sub. STAN DARD JUN.

Federation for Export

IN the tribute to the rubber industry which you publish from Lord Strathspey (*Electrical Review*, October 22nd), and for which we are grateful to him, he urges the federation of other trade associations whose members, like our own, are dependent upon a common raw material. The recommendation is all the more important when applied to those industries likely to suffer from a temporary shortage of raw materials when the war is over. Raw material shortage means controlled allocations, and these in turn involve priorities which can best be fixed in relation to an entire industry and should not be influenced by the competing claims of individual trade associations.

The rubber industry provides a good example. During the last year of peace it exported no fewer than twenty-six different products of a total value of £5,647,314. Assuming a temporary shortage of rubber after the war, which of these products should receive high priority of supply? Tyres will be important in the home market because transport is vital to reconstruction and

consequently to re-employment; yet although sports goods may appear to be inessential, in the last year of peace we sold overseas £146,087 worth of golf balls and £142,781 worth of tennis balls, which, apart from their export value, "carry the flag."

As in the rubber industry, so in others: decisions will have to be made and, from a practical point of view, these may best be based upon the recommendations of federated trade associations representing every point of view.

*London, W.C.*1. H. L. KENWARD,
Chairman, Reconstruction Committee, Federation of British Rubber and Allied Manufacturers' Associations.

A.M.I.E.E. Examination Changes

IN a leaderette in your issue of November 5th, you refer to the recent changes in the A.M.I.E.E. examination as being symbolic of the fundamental unity of engineering. The co-operation of the electrical and civil engineering technical institutions in the initial stages of their respective examinations is good; the participation of the I.Mech.E. would be better, but the participation of the Institute of Industrial Administration would be excellent.

You speak of the change being symbolic: it is a symbol only, for it does not achieve real unity. Technical training is a means to an end—to be of value to the community it must be used. Such use must, further, be organised and managed, and hence it is vital for all engineers to be introduced to the fundamentals of industrial administration. This is the title of the first examination for membership of the I.I.A., and it should be that for the last examination of any technical engineer. The engineer should be able to appreciate the purpose behind the organisations devised by the administrators, and if he is to perform his work with the maximum possible amount of operational efficiency, it is vital that the efforts of his colleagues and himself shall be properly organised.

I am strongly of the opinion that before an engineer may become a corporate member of an engineering technical institution, he should demonstrate his knowledge of the simpler aspects of organisation and management in a compulsory examination. Unity of engineering training will be achieved only when the initial examinations are identical for all institutions, and when the final examination embracing industrial administration, is common to all.

Norwich. G. V. HARRAP.

PERSONAL and SOCIAL

News of Men and Women of the Industry

TWO members of the staff of the Woking Electric Supply Co., Ltd., have recently been given honours. **Lieut. E. Didcote** (Home Guard) has been awarded the M.B.E. for duties with the Home Guard Battalion, and **Flight-Lieut. Reginald Lown** the D.F.C. for conspicuous work with the R.A.F.

Mr. J. Eccles, B.Sc., M.I.E.E., A.M.I.Mech.E., engineer and manager of the Edinburgh Corporation electricity undertaking, has been appointed city electrical engineer of Liverpool to succeed **Mr. P. J. Robinson,** who is retiring. The salary is £2,500 rising to £3,000 a year.

Mr. J. Eccles.

Mr. Eccles has been at Edinburgh since 1928, having joined the staff as senior technical assistant. He was appointed deputy engineer and manager ten years later and in 1940 succeeded Mr. E. Seddon as chief of the undertaking. Before going to Edinburgh he had secured a first-class honours degree in engineering and subsequently received practical training with one of the largest electrical manufacturing concerns in the country with whom he became construction engineer in charge of the erection of plant on site.

During the last war he won the Military Medal while serving in the ranks and later held commissioned rank.

Sir Malcolm Fraser, Bt., G.B.E., has been elected chairman of Callender's Cable & Construction Co., Ltd., and the Anchor Cable Co., Ltd. Sir Malcolm Fraser who was born in 1878, became a director of the two companies in 1923. He is also deputy-chairman of Callender's Trust, Ltd. In 1933 he visited India on behalf of Callender's to represent them at the opening of the Uhl River electrical scheme, Punjab. For this scheme Callender's had carried out the distribution equipment.

Sir Malcolm Fraser was created a baronet in 1921 and received the G.B.E. in 1923; he has been Lord Lieutenant of Surrey since 1939. During the 1914-18 war he was actively concerned in the development of the Royal Naval Air Service and was appointed Director of Aircraft Construction at the Admiralty in 1918. Lovers of the Surrey countryside owe a great debt to him for having secured by his generosity the escarpment of Box Hill from the hands of the builders. He has also given to the Dorking Council the land on which its new modern homes estate has been built.

Croydon Borough Council has unanimously agreed, on the recommendation of Mr. F. N. Rendell-Baker, chief engineer and general manager, that **Mr. H. C. Spence,** M.I.E.E., A.M.I.Mech.E., chief technical assistant, shall

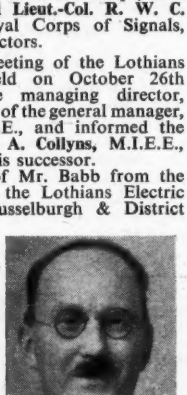
be designated deputy chief engineer and deputy general manager of the Croydon electricity undertaking. Mr. Spence received his training at Dundee Technical College and the Royal Technical College, Glasgow, and in the Dundee Corporation Electricity Department. After holding appointments with the Glasgow Corporation Electricity Department and the Yorkshire Electric Power Co. he became, in 1929, engineer and manager of the Holmfirth U.D.C. Electricity Department. He left there in 1933 to join the Croydon Corporation Electricity Department as deputy distribution superintendent, later becoming distribution superintendent and, in 1937, chief technical assistant.

Mr. W. Glass, A.M.I.Mech.E., director and works manager, has been appointed deputy managing director of Johnson & Phillips, Ltd. **Mr. S. J. Passmore** and **Lieut.-Col. R. W. C. Reeves,** A.M.I.E.E., Royal Corps of Signals, have been appointed directors.

At the senior staff meeting of the Lothians Electric Power Co. held on October 26th Mr. H. Bentham, the managing director, announced the retirement of the general manager, **Mr. H. C. Babb,** M.I.E.E., and informed the meeting that **Mr. C. H. A. Collyns,** M.I.E.E., had been appointed as his successor.

With the retirement of Mr. Babb from the general managership of the Lothians Electric Power Co. and the Musselburgh & District

Mr. H. C. Babb



Mr. C. H. A. Collyns

Electric Light & Traction Co., Ltd., Scottish electrical circles will lose the active guidance of a well-known figure. Mr. Babb graduated at the Merchant Venturers' Technical College, Bristol, and served with various electrical and mechanical manufacturing companies in that and other towns. In the electricity supply industry he held appointments with the Sheffield Electric Light & Power Co. and with the Edmundsons group in Guernsey and at Dartmouth and Hawick. At the beginning of the last war he took over the managership of the Bo'ness electricity works which was then operated by the National Electric Construction Co., Ltd., and while in that position he was also appointed Assistant Coal Controller for Scotland. In 1917 the National Electric Construction Co. appointed him general manager of the Musselburgh & District Electric Light & Traction Co., Ltd., and in 1923 he became, in addition, general manager of the Lothians Company.

Mr. Babb has been a member of the Committee of the Scottish Centre of the I.E.E., of which he was chairman in 1936. In addition he has served as chairman of the Scottish Area Committee of E.D.A. and of the Scottish Road Passenger Transport Association and has taken an active part in the affairs of the Association of Mining Electrical and Mechanical Engineers. He has also been a member since its inception of the Central Electricity Board Consultative Technical Committee for Central Scotland.

Mr. Collyns, who has been appointed acting general manager of the Lothians Co. and the Musselburgh Co., graduated in electrical engineering at the Heriot-Watt College, Edinburgh, and took up a junior appointment with the Musselburgh & District Co. He joined the mains department of the Lothians Co. in 1922 and has taken an active part in its development. During the last war he served in the Royal Flying Corps.

Professor M. L. E. Oliphant, F.R.S., has been awarded the Hughes Medal by the Royal Society for "his distinguished work in nuclear physics and mastery of methods of generating and applying high potentials."

Mr. Charles F. Collins (Collins Electrical, Ltd.), who has been absent from his office on account of illness, is now much better and hopes to resume work in about six months' time.

Mr. Walter Riggs, the president of the Electrical Contractors' Association, was married recently to Miss Edith Buse of Trebetherick, Cornwall.

Mr. W. J. Morement, a member of the Bath branch of the Electrical Contractors' Association, has been re-elected Mayor of Calne (Wilts.) for a second year.

Councillor G. Diggle, the new Mayor of Jarrow is in the service of A. Reyrolle & Co., Ltd.

Following the annual general meeting of the Renold & Coventry Chain Co., Ltd., on October 29th, at which it was announced that **Mr. A. Brampton** was resigning the chairmanship, a complimentary dinner was given in honour of Mr. Brampton by his co-directors who were accompanied by their wives. The occasion was marked by the presentation to Mr. Brampton of an antique silver bowl as a memento of his many years' association with the precision chain industry and as a token of personal esteem by all present who had known him both as a competitor and a colleague.

Obituary

Mr. W. Guy Hodge, who represented the British Thomson-Houston Co., Ltd., in South Wales for twenty-five years, died at his home in Swansea on November 3rd, aged eighty-two. Mr. Hodge served his engineering apprenticeship in the Nine Elms Works of the London & South Western Railway, and afterwards worked for Merryweather & Sons, Greenwich, Robert Hammond & Co., London, and several firms of mechanical and electrical engineers in Manchester before joining the staff of the B.T.H. Co. in June, 1904. After spending three years in the Power & Mining Department, and in the B.T.H. Manchester office, he was transferred to Swansea, and was the company's district manager from 1907 until his retirement at the end of 1932. He was very well known in South Wales engineering circles, particularly for his work in connection with the electrical equipment of collieries and rolling mills.

Boiler Design

Factors that Influence Availabilty

By V. Smith, B.Sc.Tech.

IN a previous article (*Electrical Review*, September 17th, 1943) attention was drawn to the importance of care in choosing the capacity of boiler plant and of ensuring that this capacity is maintained during the vicissitudes of operation by laying down suitable design margins and by the possible adoption of a fuel convention that would cater for any inferiorities likely to be met with in practice.

Pulverised-Fuel Firing

Closely related to the coal factor is the nature and efficiency of the fuel-burning appliances. Pulverised-fuel firing undoubtedly constitutes the best system as regards availability. Given an efficient plant it results, in the main, in smaller deposits both in the furnace and at the rear of the boiler and in these deposits, when formed, being more friable and more easily removed than those from stoker-fired boilers. With an efficient pulverised-fuel system capable of dealing with coals of low grindability and of reducing them to a fineness of about 80 per cent. through a 200-mesh screen, the whole of this country's bituminous coals can be successfully coped with, provided they are not unduly wet or of exceptionally low grade. This is not to say that coals of the latter type cannot be handled, but only that the use of very poor coal is not envisaged in the present discussion, since it is quite obvious that there must be some limiting factor on which to base design.

Dealing further with boiler availability the author suggests that there is an important field for investigation into the results obtained with furnaces of different volumes and degrees of water cooling

Makers of pulverised-fuel equipment claim ability to burn any class of coal whatsoever, and there is no reason to doubt that this is substantially correct. Once the furnace has reached a working temperature, variations of coal quality over a wide range have no effect on ease of combustion and very little on its efficiency, and this efficiency is maintained without the necessity of frequent adjustments to air supply, running speeds and other details on the part of the operating staffs. Provided that good pulverisation is maintained and that there is thorough mixing with the combustion air, the fuel burns practically like a gas.

Disadvantages of pulverised fuel are the cost of the power used by the mills and, to some extent, their maintenance and the need for electrofilters on larger boilers to deal with dust emission. On the other hand pulverised fuel possesses the following important advantages :—

(1) Increased thermal efficiency due to (*a*) higher temperature of combustion, (*b*) less excess air and therefore higher CO_2 content and (*c*) practically complete combustion and therefore low carbon loss in ash.

(2) Increased flexibility in operation, as the fuel supply can be immediately and, if required, automatically adjusted to the load whilst still maintaining a very high efficiency.

(3) No stand-by losses.

(4) Greater ease of operation, with possible reduction in labour costs.

Thermal efficiency is maintained over a wide range of conditions. The resulting reduction in fuel consumption, as compared with stoker-fired jobs, should become proportionately greater with a decrease in the fuel quality.

Stoker Firing

With stoker firing in a modern setting the range of fuels burned, whilst not so wide as with pulverised fuel, is yet considerable, if the following points are observed: (1) low stoker ratings (say 30 lb. per sq. ft. per hr. at m.c.r.); (2) ample reserves in the forced-draught system, both volume and pressure, and in the induced-draught system; (3) ample secondary air (volume and pressure) applied to the front and rear of the furnace.

The stoker rating is of great importance. It has been customary for stokers to be rated at figures up to 50 lb. per sq. ft. or more, but, whilst this may be satisfactory in regard to stoker maintenance (owing to the protection afforded by the thick bed), such ratings tend to promote more rapid slagging of the furnace and superheater tubes, probably by reason of the particles of partly burned fuel carried up by the heavy draught necessary to penetrate the bed. Air heaters are found to choke up twice as quickly when operating with highly rated as compared with moderately rated grates.

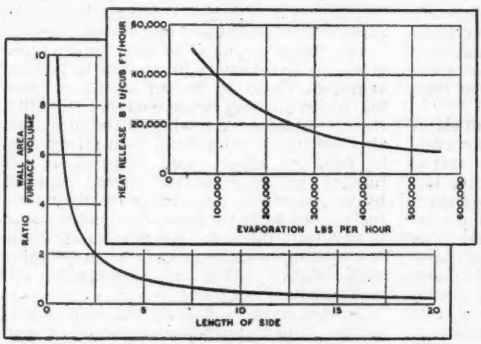
Stokers must be constructed to give good service under adverse conditions. A well-designed air-distribution system is one of the most potent factors in this regard, those grates which are capable of breaking up the under-grate air supply to the greatest possible extent, under conditions of close control, giving the greatest freedom from slagging, owing to the thorough admixture with air and resulting complete combustion.

Another direction in which improvement might be looked for is in the supply of secondary air. Whilst the under-grate supply is restricted to a temperature of about 300 deg. F. to avoid overheating of the grate, no such limitation exists for the overfire air. The proposal has therefore been made (in a paper by Mr. R. Hunt before the Midland Section of the Junior Institution of Engineers) that separate preheaters should be installed capable of giving secondary-air temperatures up to 650 deg. F. with arrangements to deliver up to 40 per cent. of the total air requirements above the grate, at pressures up to 20 in. w.g. These and other suggestions as to height, angle, number and spacing of nozzles show the possibilities of effecting improvements in combustion, which when applied to inferior fuels will undoubtedly result in greater availability.

Variations in fuel will always cause somewhat greater difficulty in operating stoker-fired furnaces, necessitating constant attention to air adjustment, stoker speeds and fuel-bed thicknesses, as well as to moisture conditioning and the avoidance of segregation These factors would seem to preclude the possibility of obtaining quite that degree of continuous operating efficiency, as compared with pulverised-fuel fired boilers, on which freedom from excess slagging largely depends.

Furnace Design

A factor of paramount influence upon availability is that of furnace size and shape, plus the degree of water cooling adopted. It is customary to judge the adequacy of furnace volume in terms of heat release, which is commonly of the order of 20,000 to 35,000 BThU per cu. ft. per hr. This does not take boiler size into account, but there are very good grounds for suggesting that the heat release should progressively decrease as the boiler size increases.



Figs. 1 and 2.—Size of boiler and heat release curves

For example, the volumes of two furnaces of approximately cubical shape (boilers of the American "integral-furnace" type give perhaps the clearest picture, but the actual type is immaterial for our purpose), one with sides 10 ft. long and the other 20 ft., would be 1,000 and 8,000 cu. ft. With the same heat-release rate, the total heat release in the second furnace would be eight times that of the first and the theoretical evaporations in about the same proportion.

Now consider the furnace wall areas. Neglecting the floor of the furnace, the respective areas are 500 and 2,000 sq. ft. a ratio of 4: 1. Thus, with the same rate of heat release the rate of "heat impingement" on the walls and roof of the larger furnace is twice that of the smaller, and to maintain the same "impingement rate" the heat release rate in the large furnace, and consequently its evaporation, would have to be halved.

The walls receiving the greater quantity of heat, *i.e.* in the larger furnace, with the greater "impingement rate," will also receive fly ash at a higher temperature until, with increasing furnace size, a point is reached where the ash liquefies, so that it adheres to the tube surfaces. In a boiler working at a given evaporation, if adherence of fused ash is taking place then an increase in furnace volume will enable the ash to cool off before it reaches the tubes, because they are further removed from the zone of intense heat, and if the volume is increased sufficiently the ash will be solid before it reaches the tubes. Thus the "heat impingement" factor is important as a criterion of furnace size.

Practical results bear this out, for instance E. G. Bailey, in his classic paper presented to the American Society of Mechanical Engineers in December, 1927, noted that a certain small boiler appeared to operate quite satisfactorily with a heat release up to 75,000 BThU whereas larger boilers were limited to 20,000 to 30,000 BThU. In a more recent paper to the A.S.M.E. in December, 1938, he stated that boilers up to 200,000 lb. per hr. operated satisfactorily, with dry ash removal, with a heat release of 25,000 to 35,000 BThU, but that large boilers demanded lower heat-release figures to prevent slagging. The reason for this appears in the author's closure to the discussion following his paper, when he pointed out that as furnaces became larger the relation between furnace volume and heat-absorbing surface changed materially, and he suggested that the BThU available per sq. ft. of heat-absorbing surface must be considered rather than the BThU per cu. ft. of furnace volume.

To arrive at a rule connecting the size of boiler and the permissible heat release, it

seems logical that this should follow the relationship between the length of side of a cube and the ratio of wall area to furnace volume. The corresponding curve is plotted in fig. 1, whilst a suggested curve for heat release is given in fig. 2. The latter shows a heat release of 25,000 BThU for a 200,000 lb. per hr. boiler, which experience suggests is about right, but for a 500,000 lb. per hr. boiler the figure is reduced to 10,000 BThU. Certainly this is considerably less than the heat release normally considered satisfactory, and in practice higher figures would no doubt prove acceptable. If, however, the above rates come to be recognised as desirable, the extra outlay for the larger furnace would still be small compared with the resulting advantages of fewer outages and smaller maintenance charges.

It is instructive to consider this matter in terms of the slag-tap furnace so largely employed in the United States. By employing heat release rates of the order of 60,000 BThU, furnace temperatures are raised to such an extent as to cause continuous fusing of the ash, which runs down to the base of the furnace and is tapped off underneath. Thus two types of boiler design are available, *viz.* high heat release with slag-tapping and low heat release of the dry-bottom design.

In Great Britain the dry-bottom furnace holds the field, and there seems no reason to depart from this practice, but there is an important sphere for investigation into the results obtained with furnaces of different volumes and degrees of water cooling in order to establish design criteria by a study of as large a number of boiler plants as possible.

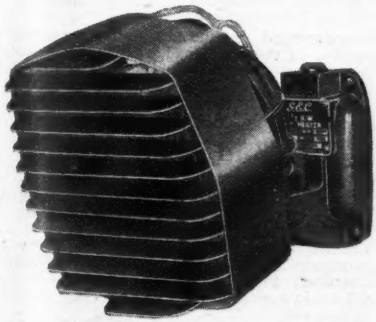
Experience has proved that boilers with large furnaces have been virtually free from slagging trouble, whereas others of the same capacity and burning similar coal, having much smaller furnaces and heavily rated grates due to site restrictions, are subject to frequent outages caused by slag.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Unit Heater

THE latest model to be added to the range of unit heaters available from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is rated at 2·5 kW. It is designed for use in small spaces in industrial premises, laboratories and offices where warmth



G.E.C. heater which can be used in summer as an air circulator

is required to be distributed evenly at the most suitable level in the working zone, at the same time maintaining a refreshing circulation of air.

The heater, which is of pleasing appearance, is mounted on a wall by means of a bracket which is an integral part of the machine; the totally enclosed driving motor is for single-phase AC only. The heating element is contained within a neatly shaped steel housing with horizontal outlet vanes and air is propelled through the heating element by a fan carried on a die-cast support which also effectively guards the blades. The whole is supported from the wall bracket by a trunnion fitted with a locking device which enables the angle of air discharge to be adjusted to 45 degrees in the vertical plane and through 120 deg. in the horizontal plane.

The removal of a small cover-plate exposes a terminal box built into the wall bracket, which is tapped top and bottom for conduit entry. One entry is fitted with a screwed fibre bush for use when t.r.s. cable is employed, while the entry not in use is blocked with a solid screwed plug. The device is quiet in operation and the possibility of damage through overheating is guarded against by the provision of a fusible link at the top of the heater, which is very compact. It projects only 11¾ in. from the wall and, when viewed from the front, is only 9½ in. square; the total weight is 16¾ lb. The appliance is finished with stoved bronze enamel.

In the summer season the heating element can be put out of circuit and the fan then performs the function of an efficient air circulator. A triple-pole switch-fuse is recommended for control so that the fan and heater circuits can be separately fused, thereby providing a convenient means of putting the heater out of circuit during the summer. With only the fan in operation the loading does not exceed 25 W.

Anchor Bolts

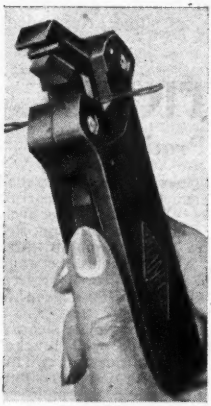
For the rearrangement of the machinery and production lines generally, when the efficient and speedy anchorage of equipment is a major consideration, PHILPLUG PRODUCTS, LTD., have devised a simple and effective anchor bolt known as the "Philbolt," which consists of a

standard hexagon headed bolt on the shank of which is placed a lead spreader and steel wedge. In practice, the assembled bolt is placed in the hole and the wedge is driven into the spreader by a short piece of piping placed over the threaded portion of the bolt. The spreader expands into the masonry and a firm anchorage is at once assured. Not the least advantage of this method is that it is not necessary to purchase complete " Philbolts," since any standard bolt of diameter appropriate to the sizes of spreader and wedge can be used.

The GENERAL ELECTRIC CO., LTD., is the sole distributor to the building trades for all " Philplug " products and supplies are available from stock.

Handy Wire Jointer

A conveniently devised electrode jointer, which enables fine wires to be united by means of a positive weld, is announced by STANELCO PRODUCTS, Ferndown, Northwood Hills, Mdx. Neither solder nor flux is required, fusion taking place within a fraction of a second of the wires being gripped in the jaws of the " Fuzit " hand tool, which is energised from a step - down transformer. After removing the insulation from the wires, they are lightly twisted together and placed in the slotted head of the jointer; thumb pressure on the handle trigger then causes contact to be made by the movable top carbon electrode.



" Fuzit " fine-wire welding jointer

Operation is thus both simple and quick, minimising the expenditure of energy. Dry joints are eliminated and macrographs clearly show that the globular union is quite free from projections of a kind that might cause penetration of any insulating covering of the joint. Oscillograms illustrating the rapidity of the operation show that the duration of the welding time is measured in milli-seconds, while copper-copper, copper-resistance and resistance-resistance wires of various compositions can be jointed satisfactorily in this way.

Moulded Lampholder

The latest moulded lampholder to be marketed by GEORGE TURNOCK, LTD., Tunion Works, Navigation Street, Walsall, Staffs, has been designed with the main object of avoiding the criticism not infrequently advanced against the bakelite variety that it is sometimes too weak round the bayonet socket to withstand hard usage. The difficulty that manufacturers have always been up against is that standard dimensions, particularly the size of the hole in shades and reflectors for lamps, were fixed long before bakelite holders were thought of, so that it would be very difficult to set up fresh standards now.

The bayonet socket portion of the " Tunion " lampholder is made of metal; it is very firmly riveted to the porcelain interior body, which accommodates the spring-plunger terminals. Since the body cannot be used without affixing the Home Office type skirt, it will always be fully insulated.

Another advantage that necessarily follows is the lessening of a difficulty so often encountered after a moulded lampholder has been in service for some time. The heat generated by the lamp causes the portion that normally carries the screw threads to expand, sometimes sufficiently to lock the shade ring so that it is hardly possible to remove it undamaged. In the new design the threaded portion of the skirt engages with the moulded cap where the temperature is less than round the lamp cap itself, so that troublesome expansion is less likely to occur.

" Tunion " improved moulded lampholder unscrewed to show interior construction

Fluid Dynamics

EXPERIMENTAL fluid dynamics is a branch of science for which there are many practical applications in nearly all branches of engineering. In this year's Andrew Laing Lecture to the North-East Coast Institution of Engineers and Shipbuilders, Dr. G. A. Hankins (National Physical Laboratory) presents the subject in a more general manner than is usually attempted.

Dynamical similarity in fluid motion and the use of Reynolds, Froude & March numbers in laboratory experiments are first considered. Practical applications of the basic principles are then described with the aid of several typical illustrations, such as oil flow in lubricated bearings. Some of the many practical applications are to flow in steam turbine nozzles and blades, valves and pipes, steam injectors, weirs and spillways, water turbines and pumps, penetration of water through soils and filters, fans and ventilation of mines and buildings, flow of molten metal in furnaces, etc.

COMMERCE and INDUSTRY

Electricians' Wages. Smoke Abatement Conference.

Red Cross Appeal

THE sixteenth list received from the organisers of the Electrical Industries Red Cross Appeal includes a covenanted subscription of £5 from Mr. Leonard Franks and donations from the Borough of Farnworth Electricity Department (£10 10s.), Kersons Manufacturing Co., Ltd. (£1 13s. 2d.) and Mr. George Abell (10s. 6d.). These raise the total received to £17,598.

Wages in the Contracting Industry

Following upon the claim for an increase of 3d. per hour in the wages of men employed in the electrical contracting industry, the National Arbitration Tribunal has awarded an advance of ½d. per hour to men in Grades B, B2 and C, but nothing to Grade A, which comprises the London district.

Dissatisfaction with the award has been expressed in London and Manchester. The London District Committee of the E.T.U. regards the award as an "insult." It advises members not to take any action likely to undermine the war effort and is asking the National Executive Council of the union to raise the matter with the Government Departments concerned and to convene a national delegate conference with a view to having the award altered or amended to bring it more into accord with the Union's claim.

Electricians in the Manchester district ceased work on Tuesday last as a protest against the award, without the sanction of their union. They demanded that a meeting of the District Joint Industrial Council should be called immediately to consider the alteration of the Tribunal's decision.

Hand Tools

Tool dealers established before August, 1939, who wish to apply for registration as merchants for the distribution of "lease-lend" hand tools under the Control of Hand Tools (No. 1) Order, 1942, should state the value of stocks of such tools normally held in their trading premises, in addition to the information already required. Applications should be made to the Director of Hand Tools (H.T. 2A), Ministry of Supply, "Woodthorne," Wergs Road, Tettenhall, Staffs.

Nuffield Educational Scheme

Free technical education and university scholarships are included in a scheme inaugurated by the Nuffield Organisation. In broad outline, the educational policy is based on a regular intake into each factory of the Organisation of a number of approved apprentices who will be graded on performance and progress, university scholarships being paid for by the Organisation for those apprentices who show the most promise. Training will be given in every branch of production and design and, in certain instances, in business management. Wages will be paid during the apprenticeship and will be not less than the standard rate for age as laid down by the Engineering Employers' Federation. Apprentices will be encouraged to attend technical colleges or schools, for which no wage deduction will be made. Another aspect of youth welfare from which every junior employee will benefit is the subsidising by the Organisation of the mid-day meal for all persons under eighteen years of age.

Commodity Insurance Premium

The Board of Trade, with the approval of the Treasury, has decided that in respect of the period beginning December 3rd, 1943, and ending March 2nd, 1944, the rate of premium payable under any policy under the Commodity Insurance Scheme shall be at the rate of 5s. per cent. for three months (or 1s. 8d. per cent. per month). This is a reduction of one-third on the rate for the current period.

Argentine Control of Communications

The Buenos Aires correspondent of *The Times* says that the interests of British and American companies in Argentina may be affected by a recent decree placing telephonic, telegraphic, and wireless communications under the supervision of the War Ministry. This appears to be one of many measures now being taken "to make Argentina more Argentine," and its scope is not yet certain. The decree draws attention to the importance of national defence, and says *inter alia* that telecommunication systems, whether federal, provincial, or private, should in peacetime be operated by Argentine-born citizens or naturalised Argentines with ten years' citizenship, excepting managerial, technical, and specialised posts, which must be held by native Argentines. The Ministries of War, of the Interior, and of Justice will study the quickest means to displace foreign staff by Argentines.

Smoke Prevention

Measures necessary to mitigate smoke nuisance in connection with post-war buildings were discussed at the conference of the Smoke Abatement Society on November 5th. These included proposals that fuel-burning plant should be approved before installation, that all new housing should be equipped with modern smokeless appliances only and with not more than one open fire (which would, of course, be smokeless) and that central areas (to be gradually extended) in all the larger towns should be scheduled as smokeless zones. The form of national co-ordination necessary to secure uniformity of practice and to disseminate technical information among the local bodies established for the approval of installations was also considered.

Caerphilly Action Fails

In the Chancery Division on November 3rd Mr. Justice Uthwatt delivered his reserved judgment in the action by the Caerphilly Urban District Council against the South Wales Electric Power Co. for a declaration that notwithstanding an agreement of May, 1939,

made between the parties, the plaintiffs were not liable to pay the defendants for electricity supplied otherwise than for the purposes of the Caerphilly Supply Order, 1922, a price higher than that fixed under the provisions of Section 12 of the Electricity (Supply) Act, 1926. They also asked for an account of the amounts paid in excess of such amounts, since December 31st, 1937, and the payment of the amount found to be due to them.

The defendants disputed that they had made the charges alleged, and pleaded that the Council had nothing to complain of.

His Lordship, in giving judgment, said that the case for the plaintiffs was that the agreement was invalid because it contravened the Act of 1926. This the defendants challenged. In March, 1922, an agreement was entered into under which the defendants contracted to supply electricity in bulk to the plaintiffs. In 1939 another agreement was entered into between the parties. Under the circumstances of the case the plaintiffs sought a declaration that they were not liable to pay a higher price for electricity than that fixed by the 1926 Act, notwithstanding the 1939 agreement. The reply of the defendants was that the 1939 agreement was invalid and that the Act did not apply to the 1922 agreement made before the passing of the Act.

The first matter was whether the proviso in a section of the Act of 1926 applied. That proviso excluded any agreement made prior to the passing of the Act, and did not interfere with the agreement that the plaintiffs entered into in 1922. The action therefore failed and he dismissed it with costs.

Failure to Isolate Switchboard

Following a recent fatal accident at the Bristol Corporation's Feeder Road power station, Charles William Ayliffe, of Weston-super-Mare, was summoned for failing to isolate the switchboard when work was being carried out.

It was stated that the accident which resulted in the death of Herbert Thomas Hughes (61), an electrician, occurred on May 2nd. Under the Factory Acts the man in charge, in this case Ayliffe, was bound either to isolate the whole switchboard or else the particular section on which work was proceeding. Ayliffe decided to isolate the individual sections, but Section 13 remained "alive." The accident was stated to have been caused by a bent isolating bar. The working platform had caught in the bar and bent it, and Ayliffe sent Hughes, one of his men, up a ladder to mend it. Apparently Hughes, in mending the isolating bar, had touched one of the connecting links in Section 13. A fine of £10, with £11 costs, was imposed.

Calendar

Mr. Christopher Wade, of Gabriel, Wade & English, has sent us an artistic calendar for 1944. The picture, entitled "Sun Bathing," is of a charming blonde in bathing attire sitting on a spring-board.

Transformer Oil Acidity

The subject of acidity in transformer oils is one of interest to all users of transformers. We have received from the Metropolitan-Vickers Electrical Co., Ltd., a leaflet describing a recommended method of test based on that outlined in Appendix VIII to B.S. 148/1933, but giving full details of the procedure for the accurate determination of acidity. Copies can be obtained on application to the company at Trafford Park, Manchester.

Defective Drill

While handling an electric drill a sixteen-year-old boy named Arthur Behan, employed in a coachbuilder's shop near Dublin received a fatal electric shock. At the inquest an engineer of the Electricity Supply Board said that the drill was defective and dangerous. The jury returned a verdict of "Accidental death."

Change of Address

The Manchester branch of Watson & Sons (Electro-Medical), Ltd., which for some time has been operated from a temporary address at Cheadle, has now returned to Manchester, the address being 30, Spring Gardens, Manchester, 2.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the following British trade marks. Objections may be entered within a month of November 3rd:—

CIRFLUX. No. 624,663, Class 9. Magnetic apparatus for the detection of flaws in metal bodies and metal surfaces.—The Equipment & Engineering Co., Ltd., 2 & 3, Norfolk Street, Strand, London, W.C.2.

PHILISOL. No. 622,582, Class 9. Scientific apparatus and instruments, electrical apparatus and instruments (not included in other classes), photographic apparatus and instruments; parts (not included in other classes) of all the said goods; and protective goggles. No. 622,583, Class 10. Ultra-violet and infra-red ray apparatus, and lamps for use therein, electro-therapeutic instruments and apparatus, electrical instruments and apparatus, all being goods for surgical, medical, dental, or veterinary purposes; apparatus for creating foam baths for medicinal or curative purposes; and parts (not included in other classes) of all the said goods. No. 622,584, Class 11. Lighting installations; parts thereof and fittings therefor, none being goods included in other classes.—Philips Lamps, Ltd., Century House, Shaftesbury Avenue, London, W.C.2. All to be associated with No. 614,983 (3337) x and others.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following :—

SEGIN electric kettle.
ELECTRO PVC Conduit.

Small Coals

Conference on Utilisation Problems

TWENTY-NINE papers were prepared for the conference on November 10th and 11th which was arranged by the British National Coal Utilisation Research Association with a view to discussing experiences in the use of small coals. Points that bear on the production of electricity are given in the following summary.

About 25 million tons of coal (nearly one-tenth of the total) mined each year would pass an ½-in. screen, the proportion tending to increase with mechanical mining; low-grade fuel and fines together account for 15 per cent. of the total. About 45 per cent. of the output is cleaned, the coal treated being mostly below 3 in., which represents about two-thirds of the aggregate. At least a quarter remains untreated, most of which is marketed as dry slack with widely varying ash content. The largest single purpose for which coal is used is steam raising, which absorbs at least one-third of the tonnage consumed in Great Britain. Small coal, under ½ in., constitutes about one-third of the entire production and much the greater part of it is burned under boilers.

Permissible Amount of Ash

In one paper, in which the principle is enunciated that the rate of heat generation per unit of time must be in excess of that required for the distillation of volatiles and for the maintenance of an ignition temperature for the carbon, it is questioned whether fuel of high calorific value favours efficiency and the view is expressed that 15 to 18 per cent. of ash—not of a colloidal or clayey nature—is unobjectionable, and that the amount of ash permissible should be determined by comparing the costs of its elimination with its transport charges. Nevertheless, other authors hold that inert contents should be removed, as far as possible, at the pits. Another view is that the blending of fines with other classes had proved successful enough to justify it as permanent practice.

Approximately 250,000 tons of coke breeze are burned annually in power stations on the sandwich system with working efficiencies up to 80 per cent., the proportion of breeze being usually about 25 per cent. when blended with rough dry slacks. Clinker, grit emission and abrasion are the chief difficulties.

When using anthracite duff pulverised-fuel units generally give best performance with a dry low-ash fuel, but with chain-grate stokers 8 per cent. ash is more satisfactory. The original plant at Tir John power station (Swansea), consisting of four 240,000 lb. per hr. boilers, has been extended. The acceptance trials gave an evaporation of 190,000 lb. per hr. at a gross thermal efficiency of 88·57 per cent. when using duff containing 15 per cent. ash and having a c.v. of 12,485 BThU per lb. Anthracite duff and coke breeze can be successfully burned in underfeed stokers when mixed with bituminous coals, provided precautions are adopted to prevent too rapid a relative combustion of the latter.

Continental experience is said to show that economical combustion depends very little on calorific value or ash or water content. The limits to the burning of pulverised fuel of high-ash content are the emission of grit and the clogging of the heating surfaces; the use of slag-tap furnaces has been advocated to obviate these difficulties.

Before the war it was calculated that every additional 1 per cent. of ash increased the cost of pig-iron by 1s. per ton and decreased the value of coal to the gas industry by 3½d. to 4½d. per ton. The average cost of transport was 3s. 7d. per ton, which worked out at 0·4d. per ton for each 1 per cent. of ash. The removal of all fines below 0·1 in. mesh was advocated as an important means of simplifying coal preparation. The undersized material could be used as pulverised fuel in power stations, but far more of it is likely to become available than can be disposed of in this way.

Draught Modification

Modifications of draught arrangements necessary when changing over from Northumberland to Kent coals of high-ash content at Croydon power station were described in a paper by Mr. G. Harper. These include the provision of booster ducts connected to the secondary air supply ducting and controlled by dampers with a view to furnishing under-grate air supplies at two pressures. This has resulted in a considerable reduction in the amount of unburnt carbon in the ash.

In power stations a wide range of coals can be burned, and the major need appears to be consistency of quality. It was submitted that it is not the coals that are at present washed that should be improved but the hitherto untreated coal. A satisfactory standard small coal of consistent quality suitable for most steam plants would, it is claimed in the paper, contain between 8 and 10 per cent. of ash and not more than 10 per cent. of moisture and be not larger than ¾ in. with not more than 25 per cent. through ¼ in. mesh; consistency, it is believed, could be achieved by rejecting pure stone only.

International Standards

Informal I.E.E. Discussion

THE first of the series of informal discussions which are to take place at the Institution of Electrical Engineers in London this winter was well attended; fourteen speakers took part.

Sir Stanley Angwin (I.E.E. President) initiated the debate by remarking that standardisation could conveniently be divided into specifications concerning materials, articles and systems, while its advantages accrued in production, reduction of excessive stocks, interchangeability and uniformity of performance. An alternative classification was into subjects which would be to national advantage without commercial complications or repercussions (like gauge dimensions) and others which it was very desirable to standardise to a substantial degree although the issue was complicated by commercial considerations (like plugs and sockets, radio components and telecommunication systems).

Sir Stanley believed that the desirability of standardisation on a national basis had been well established. He cited the work of the B.S.I. and support for it in most of the Dominions but he was surprised that formal endorsement by the Dominions was still limited to a few instances. He felt that an early decision should be made on an international basis in respect of cathode-ray tubes, to prevent repetition of the trouble occasioned by the physical differences between British and American radio valves. Examples drawn from telephone engineering practice illustrated the growing need for international standardisation of systems to facilitate cross-frontier working.

Exporters' Fears

Efforts to maintain basic differences could be ascribed in the past to competition for export trade and the fear that common standards would introduce "dumping" risks. Both aspects were ripe for discussion, particularly with reference to changes in post-war export markets and the appropriate time at which to introduce standardisation when growing development was concerned. For example, a wise decision now would greatly facilitate the exchange of inter-country television programmes in future.

Fear that national interests might have to be sacrificed in world competition must be reduced by producing articles and systems that were the best of their kinds. Astuteness in the manipulation of "standards" to secure national advantage must be deprecated and avoided in future. Wider international outlook and closer collaboration would doubtless bring remedies in their train.

Views expressed in the subsequent general discussion ranged from reasoned endorsement of the president's views to outright repudiation of the value of any form of standardisation as being a strait-jacket to initiative and inventive ingenuity. It was agreed that a growing spirit of give-and-take must precede effective expansion of international standardisation.

With regard to television, a proposal that an international committee should be appointed as soon as might be convenient to watch events and secure basic agreement about terms and definitions to avoid confusion, found wide support as an immediate and practical measure.

An attempt at definition was that standardisation meant "choice of the existing best to be agreed on for a time with changes only to be undertaken after the same careful study had been given to the problem as had decided the original standard."

Alignment of technical practice and standards achieved between certain of the United Nations for war purposes indicated what might be possible internationally. Means of facilitating the establishment of international standards was a proper subject for post-war study by the Institution.

Film on Resistance Welding

A 16 mm. instructional sound film on resistance welding has just been produced by the British Thomson-Houston Co., Ltd., in collaboration with the Ministry of Supply Advisory Service on Welding for the use of engineering societies, works groups or similar organisations. Lasting an hour, it demonstrates in detail the method of operation and the individual advantages of the various processes in common use to-day—spot, projection, seam, butt and flash welding. Scientific diagrams showing the sequence of operations are of particular value in understanding the functions of the thyratrons and ignitrons employed for controlling the time of current flow.

Besides outlining the practical steps that should be taken to ensure sound welds, the film indicates how common mistakes can be recognised and avoided. Much stress is placed on the importance of using electrodes correct for each particular job, both from the point of view of efficient welding and also of life of the electrodes.

The film will be shown to representatives of Government Departments and industry at Curzon Street Cinema, London, W.1, on Thursday, November 25th, at 2.30 p.m. Applications for tickets to attend this showing or to borrow copies should be made to the Advisory Service on Welding, Ministry of Supply, Berkeley Court, Glentworth Street, London, N.W.1.

System Maintenance

London Supply Companies' Experience

THE maintenance of distribution plant and mains on AC networks is the subject of a paper contributed by Messrs. F. N. Beaumont (London Power Co., Ltd.) and F. A. Geary (County of London Electric Supply Co., Ltd.) to the Transmission Section of the Institution of Electrical Engineers. The authors emphasise the considerable influence which design and layout of equipment has upon the frequency with which apparatus has to be examined and the time that has to be allocated to each overhaul. They consider that maintenance, combined with adequate records, can foster improved design to the mutual advantage of manufacturer and user. The paper is based on the experience of several London electricity supply undertakings operating underground cable networks at from 66 kV to 0·4 kV.

Oil Purifiers

Following brief references to staffing and operating arrangements, card record systems and tabulated schedules for essential work, the authors turn to switchgear, remarking that humidity in London distribution stations containing metal-clad gear is minimised by the extensive use of tubular heaters loaded to 60 W per ft. mounted in banks on the switch standards and controlled by thermostats adjusted for a " cut-in " temperature of 50 deg. F. Compressed cork gaskets make excellent oil-tight cover joints, while in the authors' opinion cold filtration of oil is advantageous. They comment briefly on different types of purifiers and state that, although the use of heavy oil in sealed chambers of metal-clad gear minimises leaks, the difficulty of handling it on site tends to cause the examination of such compartments to be neglected.

There is still room for much improvement of auxiliary switches in tripping circuits. After overhauls necessitating adjustment of any part of the mechanism, it is recommended that a DC low-voltage test should be carried out; a circuit diagram of compact portable apparatus for this purpose is included in the paper. It appears to be probable that future specifications will call for facilities to be embodied in insulators to enable individual insulators to be tested on site.

Treatment of transformer oil is considered, it being recommended that tap-changing types should be treated as two separate units. Standardisation of equipment in transformer chambers should be aimed at, a reasonable range being 150, 300, 1,000 kVA for either single or multiple units. The heat to be dissipated in badly ventilated chambers and street pits can be reduced by a transformer design (not described) which lowers the iron and copper losses by as much as 40 per cent. for an expenditure of not more than 20 per cent. in excess of the normal transformer cost. The additional capital expenditure is said by the authors to be fully justified by the reduced maintenance cost, particularly when load factors are high. The combination of hermetically sealed tanks with the " low-loss " transformer mentioned above has reduced maintenance of transformers, especially in street pits, almost to vanishing point.

Fire-fighting arrangements are commented upon. Consideration of relays and protective gear in general includes a circuit diagram of a small portable single-phase transformer outfit for injection testing; small power input suffices and a large measure of control is obtainable for calibrating. Relay record cards and mains records based on ordnance survey maps both require to be amplified by card indexes; duplication of all records is essential. Incidentally far less damage by bombs has been caused to cables of the armoured type laid direct than to duct routes. Armoured cables up to 11 kV at least have continued to function in bomb craters, apparently undamaged, and have worked for 2½ years since the craters were filled in. Broken ducts have caused much damage to lead-covered cables and joints have cracked when cables have been pulled along ducts by the force of explosions in craters.

The paper concludes with brief references to standardisation of cable sizes below 11 kV for the simplification of maintenance.

Battlefield Radio Stations

THE Royal Corps of Signals is using what is said to be the largest mobile radio transmitter in the world to send information from the battlefronts to the War Office. It is called the " Golden Arrow " after the former London-Paris boat train; personnel and equipment are carried in four long train-like vehicles. The crew of twenty-two comprise operators, instrument mechanics, electricians, drivers and a cook. The large transmitting valves have specially sprung mountings to guard them against the effects of severe jolting and the 70-ft. aerial masts are carried in sections on the sides of the vehicles.

One of these units is at Allied headquarters in Italy in direct communication with the War Office; others are in operation in various parts of the world; one lies at the bottom of the Mediterranean.

ELECTRICITY SUPPLY

Sale of Elgin Undertaking. Chingford Electrification.

Ashton-under-Lyne.—POWER STATION OPERATION.—At a meeting of the Town Council the chairman of the Electricity Committee denied that the local electricity works were to close. He said the actual position was that the C.E.B. had suggested that the generation of electricity should cease, not that the works should close down. A report was being prepared on all the technical and financial implications so that the Council could consider the matter before any conclusion was reached.

Barrow-in-Furness.—STREET LIGHTING. — Following representations by workers the Highways Committee has decided to provide "starlighting" in various streets at a cost of £800. The surveyor is to report on the lighting of bus routes and the Transport Committee has been asked to contribute towards the cost.

NEW CABLES.—The Highways Committee has approved proposals of the Central Electricity Board for 132-kV cables.

Birkenhead. — ADDITIONAL SUPPLIES. — The Electricity Committee is to provide additional supplies to J. Gordon Alison & Co., Ltd., in Pool Street, and to Alfred Holt & Co., Ltd., in Corporation Road, at a cost of £585, the companies having agreed to contribute £345.

Cheltenham.—FACTORY SUPPLY.—The Electricity Committee has agreed to provide an additional supply to a factory on payment of £1,000 towards the cost or on an arrangement for a guarantee to continue the supply for five years after the war.

SPECIAL TARIFF.—In cases where a consumer desires to take, under the Council's contract rate tariff, a supply of electricity for part of a works only, the requirements for the remainder being met by the consumer's own plant, such supplies are to be given and charged for at 10 per cent. in excess of the normal tariff rate.

Elgin (Morayshire).—SALE OF UNDERTAKING. —At the last meeting of the Elgin Town Council the Town Clerk read a letter from the Scottish Power Co., Ltd., regarding the sale of the electricity undertaking. The Elgin Electric Supply Co., Ltd., he stated, was contemplating transferring its undertaking to the Grampian Electricity Supply Co. (which is controlled by the Scottish Power Co.) and the chairman of the Elgin Company would like to meet the Town Council, who had certain rights under the Electricity Acts, as to the terms of the transfer.

Lichfield.—SUPPLY TO DAIRIES.—The Electricity Committee is to provide an electricity supply to the Wilts United Dairies which proposes to install plant for potato mash manufacture at premises at Bromley Hayes, the estimated maximum demand being about 100 kVA per annum, with an estimated annual consumption of 200,000 kWh.

FRINGE ORDER.—The Committee is seeking a Fringe Order for the provision of supply to Rough Park Farm, Fawley Farm and Lower Fawley Farm in the Tutbury rural district.

London.—BATTERSEA.—At a recent meeting of the Electricity Committee the general manager reported that low-voltage feeders were becoming fully loaded and that it would soon be necessary either to lay additional low-voltage feeders or provide a new transformer house in that area. The latter course was preferable as it would avoid the losses which occurred in long low-voltage feeders and would assist in giving better voltage regulation. The Committee decided to acquire a site for a transformer house.

Southport.—ECONOMISER REPLACEMENT.—The Electricity Committee is to replace a boiler economiser at the power station at an estimated cost of £2,000.

Warrington.—PROVISION FOR EXTENSIONS.—The Electricity Committee is recommending the Town Council to approve the laying of three four-way ducts ready for cables to be laid at a later date.

Overseas

Russia.—DONBAS ELECTRICITY RESTORED.—Moscow radio stated on November 5th that a big electric power plant feeding a large area in the Donbas, including parts of the Rostov and Voronezh regions, has been restored. The plant, wrecked with scientific thoroughness by the retreating Germans, was rebuilt as a first priority.—*Reuter.*

TRANSPORT

London.—RAILWAY ELECTRIFICATION.—On November 3rd in the House of Commons Mr. McEntee asked if plans were being prepared for the electrification of the railway from Liverpool Street to Chingford at an early date after the end of the war and what extension was proposed beyond there. Mr. Noel-Baker, Parliamentary Secretary, Ministry of War Transport, said that a special committee appointed by the four main line railways and the L.P.T.B. was now considering the electrification of the line to Chingford and other plans for future railway development in the London area.

Nottingham.—WOLLATON TROLLEY-BUS SERVICE.—After a public inquiry into an application for powers to extend the trolley-bus service to Wollaton, the Minister of War Transport informed the Corporation that he was prepared to authorise the extension on certain conditions. The chief of these was that the Midland General Omnibus Co., Ltd., and the Trent Motor Traction Co., Ltd., which operate over the route, should be given an interest in the service. The Corporation could not accept these terms. According to the *Journal* of the Public Transport Association, the Midland General Omnibus Co., Ltd., has since made submissions to the Minister with a view to applying for an Order permitting it to institute a trolley-bus service from Ilkeston to join the Nottingham Corporation's system at Middleton Boulevard. If the Order were granted the company would allow the Corporation facilities for participating in the running of trolley-buses between the city centre and Wollaton. It is understood that the proposal is not acceptable to the Corporation.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Telephone Properties, Ltd., reports a net profit for 1942 of £24,503, as compared with £35,798 for the preceding year. After deducting dividends for eighteen months to December 31st, 1942, on the preference shares, and placing £5,000 to reserve for contingencies, a balance of £40,450 is carried forward, against £38,259 brought in.

In the course of his speech at the annual meeting held to-day (Friday), Sir Alexander Roger (chairman), in referring to the Nacional Telephone Co. of Venezuela (with which Telephone Properties is closely connected), said that that company had added 1,743 stations to its system during the year under review, raising the total to 35,821. This was the lowest expansion figure since 1935 and was due to shortage of supplies and the adoption of a cautious policy to make the best use of materials available.

Murex, Ltd., held its annual meeting on November 4th, when Mr. G. P. Joseph (chairman) said that Murex Welding Processes, Ltd., their wholly-owned subsidiary, had shown further considerable expansion in the past year and continued to maintain its strong position in the electric arc welding industry. Electric welding had made a notable contribution to the war effort and he was confident that its application in all branches of post-war industry would show a marked expansion over the pre-war era.

Max Stone, Ltd., reports a trading profit for the year to June 30th of £58,079, as compared with £56,005 for the previous year, and a net profit of £11,957 against £8,492. The ordinary dividend for the year is maintained at 10 per cent., less tax, general reserve receives £5,000 and £5,961 is carried forward against £7,104 brought in.

Yarrow & Co., Ltd., show a profit for the year to June 30th last of £58,816 (against £57,441). The general reserve again receives £35,000 and the dividend is 10 per cent. plus a bonus of 5 per cent., free of tax, as last year.

The British Electric Resistance Co., Ltd., is paying a first and final dividend of 20 per cent. less tax (unchanged).

Metal Industries, Ltd., has declared an interim ordinary dividend of 2½ per cent. (same) less tax at 9s. 9d. in the £.

The Revo Electric Co., Ltd., is again paying an interim dividend of 5 per cent.

The United River Plate Telephone Co., Ltd., is again paying an interim dividend of 3 per cent.

New Companies

O'Connor Electrical Industries, Ltd.—Private company. Registered October 30th. Capital, £1,350. Objects: To acquire the business carried on by L. L. F. O'Connor at 30, St. George Street, W.1, and to carry on the business of electricians, engineers, etc. Directors: L. L. F. O'Connor, 30, St. George Street, W.1, T. J. O'Connor, address not stated, and R. C. Freeman, 30a, St. George Street, W.1. Solicitors: Freeman & Son, 30a, St. George Street, W.1.

Tenaplas (Insulators), Ltd.—Private company. Registered October 26th. Capital, £10,000. Objects: To carry on the business of manufacturers of, and dealers in, insulating materials, cables, wires, cords, plastics, wireless sets and accessories, etc. Subscribers: G. Conrad, 103, Phyllis Avenue, New Malden, and E. W. Rosier, 1, Grunhurst Road, S.E.27. Solicitors: Clifford Turner & Co., E.C.2.

William Ewart, Ltd. — Private company. Registered October 27th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, electrical, motor and other appliances and fittings, etc. Directors: W. J. Hunt, 41, Worcester Lane, Four Oaks, Sutton Coldfield, and N. B. A. Bosworth, 55, Temple Row, Birmingham. Registered office: 55, Temple Row, Birmingham.

Companies' Returns

Statements of Capital

Buckrose Light & Power Co., Ltd.—Capital, £200,000 in 200,000 ordinary shares of £1 each. Return dated August 4th. 180,000 shares taken up. £180,000 paid. Mortgages and charges: Nil.

Dowsing Company (Electrical Manufacturers), Ltd.—Capital, £15,000 in £1 shares (all ordinary). Return dated August 11th. 13,451 shares taken up. £11,951 paid. £1,500 considered as paid. Mortgages and charges: £500.

Hutchings & Cunnington, Ltd.—Capital, £2,500 in £1 shares. Return dated August 5th. 2,367 shares taken up. £2,367 paid. Mortgages and charges: Nil.

Bastian & Allen, Ltd.—Capital, £5,000 in £1 shares. Return dated August 11th. All shares taken up. £5,000 paid. Mortgages and charges: £5,000.

Siemens-Schuckert (Great Britain), Ltd.—Capital, £30,000 in £1 shares. Return dated July 13th. 29,405 shares taken up. £29,405 paid. Mortgages and charges: £4,706 16s. 11d.

Receiver Released

Ellis P. White, Ltd.—S. P. Child, C.A., ceased to act as receiver and manager on October 25th, 1943.

Bankruptcies

S. Mendelson (Mendelson & Co.), wholesale radio and electrical factors and importers, 12a, Churchgate, Leicester.—Application for discharge to be heard on December 9th at the Castle, Leicester.

N. E. Butcher (Herts Electrochemical Co.), battery manufacturer, 2, Woodfield Road, Welwyn Garden City, Herts.—Last day for receiving proofs for dividend November 20th. Trustee, Mr. S. P. Child, College Hill Chambers, Cloak Lane, London, E.C.4.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets are pursuing the even tenor of their way. In some parts of the House, members are busy—are visibly booking bargains. In other parts the main feature is a slackness of trade, with its accompanying corollary of dull prices. Gilt-edged securities hold their ground, while Home Rails have gone back after last week's burst of exuberance. Shares in front-rank industrial companies show a wilting tendency. Recent speculation in radio shares has given way to a quieter and more cautious state of affairs in that market.

Home Rails React

The reassuring statement made by Lord Leathers in regard to the Government's intentions concerning the Home railways had a strengthening effect at first, but upon subsequent reflection, sellers came into the Home Railway market and prices gave way sharply from the best levels they had touched. No doubt, the early rise was somewhat enthusiastic, and this had the effect of offering prospective sellers the chance they had been waiting for in order to get out of their stock, a chance of which they were not slow to take advantage. For a few days the fluctuations were considerable, but on balance the sellers obtained the upper hand, and prices are mostly lower than they were a week ago. Southern Railway preferred at 79, showing 2 points rise, stands out as one of the firmest spots in the group. London Passenger Transport "C" has been little affected.

The decline in the price of Thomas Tilling shares to 56s. is attributed in the market to nothing more exciting than realisation of the fact that, at the former price, the shares were standing decidedly high in relation to the yield which the present-paid 10 per cent. dividend provides for them. A return of 3½ per cent. on the money is hardly sufficient even in these spacious days, and holders of the shares, presuming the likelihood of there being no increase in the dividend during the war, sold some of their stock as the price steadily improved. Upon the buyers being satisfied, the selling movement continued and had the effect of reducing the price.

Movements in Prices

Doubt as to whether the present range of industrial share prices is not unduly high finds reflection in a tendency for quotations to go back. The falls are insignificant in extent, but they indicate the investors' disposition at the moment. Enfield Cables are a cheerful exception, with a 1s. rise to 59s. By comparison with shares in companies somewhat similarly employed, Ever Ready ordinary seem moderately priced at 39s. ex dividend, the yield being 5⅛ per cent. on the money. Ericsson Telephones lost 1s. 6d., receding to 50s. Westinghouse Brakes are down 1s. to 66s. 3d.; Vactric 5s. shares at 13s. have gone back 6d. No recovery has occurred in the radio market. Conditions there are lifeless. Speculation has turned to South African mining shares. Consequently, A. C. Cossor shares are 1s. lower at 22s. 6d.; E.M.I. shares at 25s. 6d. and E. K. Cole at 24s. 6d. show small losses.

The Murex meeting produced no fresh information and the price of the shares remains at 95s.

Miscellaneous Matters

No change worth special mention has occurred in electricity supply shares. The Canadian issues are quietly dull. Shawinigan Power have fallen a dollar to 15, and Montreal Light & Power remain weak at 20¼. New York put down prices in Wall Street, upon talk of a possible early conclusion to the war, and, by way of sequel, a severe contraction of industries now employed to capacity upon war work. Brazilian Tractions fell ½ to 27¾. Mexican Light & Power fives are 2½ down. The Anglo-Argentine Tramway issues are easier. Calcutta Trams at 39s. ex dividend have lost about 9d. and Calcutta Electric shed 6d. to 37s. Cable & Wireless ordinary at 76½ put on the fraction, but Globe Telegraph & Trust ordinary shares went back 1s. to 36s. A few Oriental Telephones came to market, and the price fell 9d. to 44s. 9d. Atlas Electrics are again 3d. down at 69.

Telephone "Props"

Telephone Properties ordinary shares are still to go without a dividend, but in the statement accompanying the report the chairman points out that the arrears of dividend on the preference shares have now been cleared off. This, of course, brings the ordinary shares into nearer sight of a resumption of dividends. The price is 6d. lower at 16s. 6d. British Electric Resistance hardened to 5s. for the florin shares, upon declaration of a 20 per cent. dividend. De La Rue gave way to 8¾, Ransome & Marles to 81s. 3d. Lucas are better at 72s. 3d.

British Insulated

Reference has been made on several occasions to the manner in which the price of British Insulated shares advanced until it got out of step with others in the same group. No specific reason could be found to account for this steady rise which carried up the price at one time to 113s. 9d., showing a yield, on the basis of the 20 per cent. dividend generally paid, of 3½ per cent. on the money. This compared with a higher return which could be secured from Henley's and Callender's. To account for the rise, some people surmised

(*Continued on page* 660)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Nov. 9	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	61/–	..	4 1 2
British Power and Light	6	7	32/6	..	4 4 9
City of London ..	7	7	28/–	..	5 0 0
Clyde Valley ..	8	8	39/6	..	4 1 0
County of London	8	8	40/6	..	3 19 0
Edmundsons:					
7% Pref. ..	7	7	33/–	+3d.	4 4 10
Ord.	6	6	28/6	..	4 4 3
Elec.Dis.Yorkshire	9	9	44/–	..	4 1 10
Elec. Fin. and Securities ..	12½	12½	53/6	..	4 13 4
Elec. Supply Corporation ..	10	10	46/–	..	4 7 0
Isle of Thanet ..	Nil	Nil	18/–	..	—
Lancs. Light and Power ..	7½	7½	34/6	..	4 7 0
Llanelly Elec. ..	5½	6	25/6	..	4 14 1
Lond.Assoc.Electric	4	3	23/–	..	2 12 2
London Electric	6	6	27/6	..	4 7 3
LondonPowerRed. Deb.	5	5	103½	..	4 16 7
Metropolitan E.S.	8	8	41/–	..	3 18 0
Midland Counties	8	8	39/–	..	4 2 0
Mid. Elec. Power	9	9	42/6	..	4 4 9
Newcastle Elec...	7	7	31/–	..	4 10 5
North Eastern Elec.:					
Ordinary ..	7	7	32/6	..	4 16 2
7% Pref. ..	7	7	33/6	..	4 3 7
Northampton ..	10	10	47/6	..	4 4 0
Notting Hill 6% Pref. (£10) ..	6	Nil	10	..	—
Northmet Power:					
Ordinary ..	7	7	37/6	–6d.	3 14 8
6% Pref. ..	6	6	29/6	..	4 0 0
Richmond Elec. ..	6	6	26/–	..	4 12 4
Scottish Power ..	8	8	38/6	..	4 4 4
Southern Areas ..	5	5	22/–	..	4 10 11
South London ..	7	7	26/6	..	5 5 8
West Devon ..	5	5	23/6	..	4 5 0
West Glos. ..	4½	3½	24/–	..	2 18 4
Yorkshire Elec...	8	8	41/–	..	3 18 0
Overseas Electricity Companies					
Atlas Elec. ..	Nil	Nil	6/9	–3d.	—
Calcutta Elec. ..	7*	6*	37/–	–6d.	3 4 10
Cawnpore Elec...	10	10	35/6	..	5 12 8
East African Power	7	7	33/6	..	4 3 7
Jerusalem Elec...	7	5	28/–	..	3 11 5
Kalgoorlie (10/–)	5	5	10/–	..	5 0 0
Madras Elec. ..	4*	Nil	22/6	..	—
Montreal Power	1½	1½	20½	..	7 6 4
Palestine Elec."A"	4*	5*	41/–	..	2 8 10
Perak Hydro-elec.	6	7	13/6	..	—
Shawinigan Power	83cts.	90cts.	15	–1	—
Tokyo Elec. 6%	6	6	22	..	—
VictoriaFallsPower	15	15	4½	..	3 9 7
Whitehall Inv.Pref.	—	—	25/–	..	4 0 0

Company	Dividend Previous	Dividend Last	Middle Price Nov. 9	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955–60 (Civil Defence) ..	—	3	99½	..	3 0 4
1955–75 ..	5	5	113½	..	4 8 0
1951–73 ..	4½	4½	107	..	4 4 1
1963–93 ..	3½	3½	101xd	..	3 9 4
1974–94 ..	3½	3½	98½	..	3 6 0
LondonElec.Trans. Ltd.	2½	2½	97	..	2 11 3
London & Home Counties 1955–75	4½	4½	111	..	4 1 1
Lond.Pass.Trans.:					
A	4½	4½	116½	..	3 17 3
B	5	5	116½	..	4 5 10
C	2½	3	69	..	4 7 0
WestMidlandsJ.E.A. 1948–68 ..	5	5	109	..	4 11 9
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	115xd	..	5 4 4
Def.	1½	1½	27½	..	5 9 1
Anglo-Portuguese	8	8	24/–xd	+3d.	6 13 4
Cable & Wireless:					
5½ Pref. ..	5½	5½	110	..	5 0 0
Ord.	4	4	76½	+½	5 4 7
CanadianMarconi$1	Nil	4cts.	9/–	..	—
Globe Tel. & Tel.:					
Ord.	8½*	5*	36/–	–1/–	2 15 7
Pref.	6	6	29/–	..	4 2 9
Great NorthernTel. (£10)	Nil	Nil	23½	..	—
Inter. Tel. & Tel.	Nil	Nil	16	..	—
Marconi-Marine..	7½	7½	32/9	..	4 11 7
Oriental Tel. Ord.	16	10	44/9	–9d.	—
Telephone Props.	6	Nil	16/6	–6d.	—
Tele.Rentals(5/–)	10	10	10/9	..	4 13 0
Traction and Transport					
Anglo-Arg.Trans.:					
First Pref. (£5)	Nil	Nil	3/–	–6d.	—
4% Inc. ..	Nil	Nil	9	–1	—
Brit.Elec.Traction:					
Def. Ord. ..	45	45	1070xd	–20	4 3 4
Pref. Ord. ..	8	8	175	..	4 11 5
Bristol Trams ..	10	10	52/–	..	3 17 0
Brazil Traction ..	$1	$1⅛	27⅜	–⅛	6 10 0
Calcutta Trams..	5½	6½	39/–xd	–9d.	3 6 8
Cape Elec. Trams	5	6	24/–	..	5 0 0
Lancs.Transport	10	10	44/3	..	4 10 4
Mexican Light:					
1st Bonds ..	5	5	107½	–3	4 13 0
Rio 5% Bonds ..	5	5	107½	..	4 13 0
Southern Rly.:					
5% Prefd. ..	5	5	79	+2	6 6 7
5% Pref. ..	5	5	113	+1	4 9 3
T. Tilling ..	10	10	56/–	–1/–	3 11 5
West Riding ..	10	10	43/–	..	4 13 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Nov. 9	Rise or Fall	Yield p.c. £	s.	d.
Equipment and Manufacturing							
Aron. Elec. Ord. .	10	15	55/–	..	5	9	1
Assoc. Elec. :							
Ord.	10	10	48/–	−2/–	4	3	4
Pref.	8	8	39/–	..	4	2	1
AutomaticTel.&Tel.	12½	12½	59/6	..	4	4	0
Babcock & Wilcox	11	11	48/–	..	4	11	7
British Aluminium	10	10	47/–	..	4	5	1
British Insul. Ord.	20	20	5½	+½	3	16	4
British Thermostat (5/–)	18½	18½	19/–	..	4	17	4
BritishVac.Cleaner (5/–)	15	30	27/–	..	5	11	1
Brush Ord. (5/–)	6	8	9/3	..	4	6	6
Burco (5/–) ..	15	15	16/–	..	4	13	9
Callender's ..	15	20	97/6	−⅛	4	2	0
ChlorideElec.Storage	15	15	82/6	..	3	13	0
Cole, E. K. (5/–)	7	10	24/6	−6d.	2	0	10
Consolidated Signal	17	24	5½	..	4	3	6
Cossor, A. C. (5/–)	7½*	10*	22/6	−1/–	2	4	6
Crabtree (10/–) ..	17½	17½	38/9xd	..	4	10	2
Crompton Parkinson Ord. (5/–) ..	20	20	26/–	..	3	17	0
E.M.I. (10/–) ..	6	8	25/6	−3d.	3	2	7
Elec.Construction	10	12½	51/3	..	4	17	6
Enfield Cable Ord.	12½	12½	59/–	+1/–	4	4	9
English Electric..	10	10	47/6	−6d.	4	4	3
EnsignLamps(5/–)	25	25	22/6	..	5	11	1
Ericsson Tel. (5/–)	22*	20*	50/–	−1/6	2	0	0
Ever Ready (5/–)	40	40	39/–xd	..	5	2	7
Falk Stadelmann	7½	7½	52/–	..	4	13	9
Ferranti Pref. ..	7	7	29/6	..	4	15	0
G.E.C. : Pref. ..	6½	6½	32/–	..	4	1	3
Ord. ..	17½	17½	89/6	−6d.	3	18	2
Greenwood&Batley	15	15	42/6	..	7	1	2
HallTelephone(10/–)	12½	12½	25/3	..	4	19	0
Henley's (5/–) ..	20	20	24/9	..	4	0	10
4½% Pref. ..	4½	4½	23/–	..	3	18	3
Hopkinsons ..	15	17½	62/–	..	5	13	0
India Rubber Pref.	5½	5½	21/6	..	5	2	4
Intl. Combustion	30	30	6½	..	4	16	0
Johnson & Phillips	15	15	68/6	..	4	7	7
LancashireDynamo	20	22½	92/9	..	4	17	0
Laurence,Scott(5/–)	15	12½	11/6	..	5	8	8
London Elec. Wire	7½	7½	32/6	..	4	12	3
Mather & Platt ..	10	10	51/3	..	3	18	9
Metal Industries(B)	5	8	45/–	..	3	11	2
Met.Elec.CablePref.	5½	5½	21/3	..	5	3	6
Murex	20	20	4½	..	4	4	2
Pye Deferred (5/–)	25	25	25/–	..	5	0	0
Revo (10/–) ..	17½	17½	40/–	..	4	7	6
Reyrolle ..	12½	12½	70/–	..	3	11	5
Siemens Ord. ..	7½	7½	34/3	..	4	7	7
Strand Elec. (5/–)	7½	10	7/9	..	6	9	0
Switchgear&Cowans (5/–) ..	10	20	18/–	..	5	11	1
T.C.C. (10/–) ..	5	5	20/–	..	2	10	0
T.C. & M. ..	10	10	53/–	..	3	15	6
TelephoneMfg.(5/–)	9	9	11/6	..	3	18	3
Thorn Elec. (5/–)	20	20	21/9	..	4	12	0
Tube Investments	20	20	92/6	..	4	6	7
Vactric (5/–) ..	Nil	Nil	13/–	−6d.	—		
Vickers (10/–) ..	10	10	18/–	..	5	11	1
WalsallConduits(4/–)	55	55	45/–	..	4	17	9
Ward & Goldstone (5/–)	20	20	26/3	..	3	16	2
WestinghouseBrake	10	12½	66/3	−1/–	3	15	6
West, Allen (5/–)	7½	7½	7/–	..	5	7	2

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page 658*)

that there might be an increase in dividend before long, the impression being prompted by the advance of 5 per cent. to 20 per cent. in the Callender's Cable dividend. At the same time, rumour sported with gossip concerning a possible absorption or amalgamation. With no definite news, either in regard to the dividend or the report just mentioned, British Insulated have come back to 5½, at which the return on the money is £3 16s. 6d. per cent. Callenders are ⅛ down at 97s. 6d., the return on these at that price being £4 2s. per cent.

Crabtree Electrical

The preliminary statement of Crabtree Electrical Industries, Ltd., was given here last week. The net profit of £53,305 was less than half of that returned for the previous year. Besides providing for E.P.T. liability, the directors decided also to set aside a sum to be used in payment for repairs at present deferred. The company's trading profit of £244,000 is nearly £19,000 higher on the year. The dividend and bonus are repeated at 17½ per cent. and at the present price of 38s. 9d. ex dividend, the yield is 4½ per cent. on the money. The company has paid an annual 17½ per cent. since its inception in 1936 and the trading profit just referred to of £244,000 compares with £171,000 two years ago.

Telephone & General

Ten thousand ordinary shares in Telephone & General Trust, Ltd., an Alexander Roger company, have been on offer at 33s. 3d. The company directly controls the Anglo-Portuguese, the Barbados and the Jamaica Telephone companies, Telephone Properties, Ltd., and Trinidad Consolidated Telephones, Ltd. It also has a substantial interest in British Insulated Cables and Automatic Telephones. The Automatic Telephone Company holds all the 100,000 " A " ordinary shares in the Telephone & General Trust and these carry half the votes of the company. A regular annual dividend of 8 per cent. has been paid on the ordinary shares for nine years past and security, measured by the company's investments and reserves, affords ample cover to the ordinary shares. The yield at 33s. 3d. on the basis of the 8 per cent. dividend is £4 16s. per cent., which may seem a comparatively meagre return justified by the sound financial position.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Dewsbury.—November 22nd. Rewiring of the electrical installation of Staincliffe County Hospital. West Riding C.C. architect, County Hall, Wakefield.

Edinburgh.—November 18th. Corporation Electricity Department. Paper-insulated cables. Specification No. 189. Electrical Engineer's Office, Dewar Place.

Macclesfield.—November 17th. Electricity Department. 11-kV switchgear. (October 15th.)

Rochdale.—Electric lighting and power installation, Middlewood Remand Home, Wardle; S. H. Morgan, borough surveyor, Town Hall.

Wick.—November 22nd. Town Council. Electric lighting work in erection of 14 blocks comprising 40 houses. Specifications from burgh surveyor (fee £2 2s.). Tenders to town clerk.

Orders Placed

Workington.—Water Committee. Electrically operated pumps (two units) and meters.—Pulsometer Engineering Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alloa.—Extension to offices for Harland Engineering Co., Ltd., Caledonian Road; manager.

Bootle.—Cleansing centres (£3,682); borough engineer.

Bournemouth. — Sleeping accommodation A.R.P. depots (£3,200); borough engineer.

Brechin.—Day nursery; burgh engineer, 30, Panmure Street.

Brighouse.—Workshops; R. A. Blakeborough, Raths Ryg, Shepherd Thorn Lane.

Chelmsford.—Machine shop, 58, Hickman Road; H. & L. Brown.

Rebuilding workshop, Market Road; A. J. Arnold.

Cheltenham.—Rebuilding warehouse, 12-14, Hewett Road; R. E. Doole.

Annexe, Municipal Offices (£2,800); borough engineer.

Chester.—Additions to hospital (£1,369); borough engineer.

Coventry.—Reinstatement of wards, Coventry and Warwickshire Hospital, Stoney Stanton Road (£1,700); secretary.

Croydon.—School huts, Addington (£3,500) and extensions to Selhurst Road Polytechnic (£2,000); borough engineer.

Enfield.—Additions to works; L. Robinson.

Additions to store, Lockfield Avenue, and canteen for Boosey & Hawkes; Biltons, Ltd.

Chemical building for Thomas Morson & Son, Ltd.; Tooley & Foster.

Gateshead.—Offices, Oakwellgate; Reay Gearworks, Ltd.

Glasgow.—Finishing shop; E. Sanderson.

Substation, Govan; Fairfield Shipbuilding & Engineering Co., Ltd.

Golborne.—Buildings for Youth Institute; G. Moss & Sons, Ltd., builders, Back St. Helens Road, Leigh, Lancs.

Great Yarmouth.—Workshop, St. Nicholas Road; F. Conway, town clerk, Town Hall.

Halifax.—Additions, Shelf Mills; E. Illingworth & Co. (Bradford) Ltd., waste merchants, Shelf.

Hereford.—Offices, St. John Street; War Agricultural Committee.

Ilford.—Junior school, Hainault (£4,800); W. T. Stubbs & Sons, Ltd.

Kidderminster.—Crematorium; J. Hawcroft, borough surveyor, Surveyor's Offices, Mill Street.

Lancashire. — Extensions to Upholland Grammar School for County Education Committee; Martlew Bros., builders, Cross Lane, Billinge Higher End, Orrell, near Wigan.

Central kitchen, Denton; L. Evans, county architect, County Buildings, Fishergate Hill, Preston.

Leeds.—Building for school canteen; W. S. Cameron, city engineer.

Leicester.—Young People's Colleges (10); J. L. Beckett, city surveyor, Town Hall.

Liverpool.—Nurseries at Upper Canning Street, Allenby Square, East Prescot Road, and other sites; L. H. Keay, city architect, Blackburn Chambers, Dale Street.

London.—PUTNEY.—Extensions to limb-fitting centre, Queen Mary's Roehampton Hospital; Moore & Wood, Ltd., builders, 262, Langham Road, London, N.15.

WANDSWORTH.—Nursery (£2,800), Summerley Street; A. Offer & Son, contractors, Station Road, Balham, S.W.12.

CLAPHAM.—Workshop; Walter Bridges & Co., engineers, 37, Parliament Street, S.W.1.

Canteen, etc., 9, Park Hill; A. B. Strachan, Gayton Road, Harrow.

Lytham St. Annes.—Crematorium; G. W. Lawson, borough surveyor, Town Hall.

Manchester.—Office and store; Middlesex Steel Bending & Fixing Co., Ltd.

Experimental houses with electrical work and labour-saving appliances, etc.; J. Hughes, housing director, Town Hall.

Flats, West Didsbury; A. R. Walsingham, architect, 50, High Grove Lane, Cheadle, Cheshire.

Nairn.—Houses; burgh surveyor.

North Shields.—Additions to works; Hadden & Hillman, builders, 127, New Bridge Street, Newcastle-on-Tyne.

Northumberland.—New operating theatre at Mental Hospital; canteens at 50 schools; three new schools at Bedlington, Stannington and Lynemouth and decontamination laundry at Berwick; county architect, County Hall, Newcastle-on-Tyne.

Nuneaton.—Central kitchen and dining-rooms at Stockingford Council School; borough surveyor, Council House, Coton Road.

Oldham.—Works canteen; George Clegg (Oldham), Ltd.

South Shields.—Establishment of new light industry; F. W. Newby, architect, King Street.

Staffordshire.—Reconstruction of Stafford County Mental Hospital; C. M. Coombs, county architect, County Offices, Stafford.

Extensions to Stone Grammar School; A. C. H. Stillman, county education architect, County Buildings, Stafford.

Stockport.—Showroom, offices, etc., Wyatt Street; T. A. Hollinshead, 52, Wellington Road North.

Tettenhall.—Adaptation of Tettenhall Towers for extensions to Tettenhall College; secretary.

Warrington.—Works extensions, Mersey Mills; J. Fairclough & Sons, Ltd., corn millers, Bank Quay.

West Suffolk.—Erection of canteen block at Bury St. Edmunds County School; county architect, Westgate House, Bury St. Edmunds.

Wigan.—Reinstatement of laundry buildings and machinery after fire; Borough Model Laundry, Ltd., St. Helens Road, Over Hulton, near Wigan.

Erection of eight precast buildings for school dining halls; L. Lyons, borough engineer, Municipal Buildings, Wallgate.

Worthing.—Temporary school (£1,100); borough engineer.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

BRITISH Thomson-Houston Co., Ltd.—"Electrical energy storage welding systems." 5997/42. May 2nd, 1941. (556733.) "Speed control systems for electric motors." 3652/42. March 22nd, 1941. (556773.) "Compressor assemblies, particularly for refrigerators." 4902/42. April 17th, 1941. (556779.) "Frequency convertors for wireless reception." 3354/41. March 12th, 1940. (556789.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—"X-ray tube." 7324. May 29th, 1942. (556787.)

British Thomson-Houston Co., Ltd., and F. E. Butler.—"Systems of electric motor control." 7131. May 26th, 1942. (556786.)

R. Calvert.—"Synchronisation of alternating-current sources particularly applicable to common wavelength broadcasting systems." 4307. March 31st, 1942. (556855.)

J. O. Farrer (Aktiebolaget Industrimetoder).—"Process for electropolishing metal, especially articles of stainless steel." 1977. February 5th, 1943. (556797.)

Hoover, Ltd.—"Suction cleaners." 5220/42. June 21st, 1941. (556816.)

Johnson Laboratories, Inc.—"Image suppression systems for radio receivers and the like." 3665/42. May 15th, 1941. (556774.)

Marconi's Wireless Telegraph Co., Ltd.—"Frequency modulation receivers." 8324/42. June 17th, 1941. (556724.) "Frequency-modulated oscillation generator." 13799/42. October 2nd, 1941. (556852.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).—"High-frequency amplifying tubes." 11336. September 4th, 1941. (556769.)

A. Plotzker (known as G. A. Walsh).—"Clips for securing flexible or other electric conductors in place." 12723. September 9th, 1942. (556847.)

S. J. Smith.—"Electric resistors." 10148. July 21st, 1942. (556726.) "Valve voltmeters." 10149. July 21st, 1942. (556727.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—"Radio directing finding systems." 5119. April 17th, 1942. (556759.)

Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.).—"Devices responsive to electric impulses." 13431. September 24th, 1942. (556850.)

Standard Telephones & Cables, Ltd., and A. R. Harding.—"Washers for screws." 5115. April 17th, 1942. (556758.)

Standard Telephones & Cables, Ltd., and M. M. Levy.—"Generators of electric oscillations." 5114. April 17th, 1942. (556757.)

Standard Telephones & Cables, Ltd., H. M. M. d'Assis-Fonseca and H. J. Ward.—"Electric signalling systems." 4889. April 14th, 1942. (556745.)

Standard Telephones & Cables, Ltd., H. S. Bishop, C. B. Pierce and A. S. Bridge.—"Electric soldering irons." 5315. April 21st, 1942. (556835.)

Standard Telephones & Cables, Ltd., E. A. H. Bowsher, H. M. M. d'Assis-Fonseca and H. J. Ward.—"Electrical remote indicating and supervisory systems." 3258. March 12th, 1942. (556739.)

S. N. Watson and T. Worswick.—"Electrical signal converting circuits." 5157. April 17th, 1942. (556762.)

Westinghouse Brake & Signal Co., Ltd., and R. M. MacGregor.—"Track signalling systems for railways and the like." 3050. March 9th, 1942. (556807.)

Westland Aircraft, Ltd., W. E. W. Petter and P. J. Swaffield.—"Electric remote control apparatus." 3354. March 13th, 1942. (556714.)

J. White.—"Methods of coating articles and of making electrical resistances." 3116. March 10th, 1942. (556738.)